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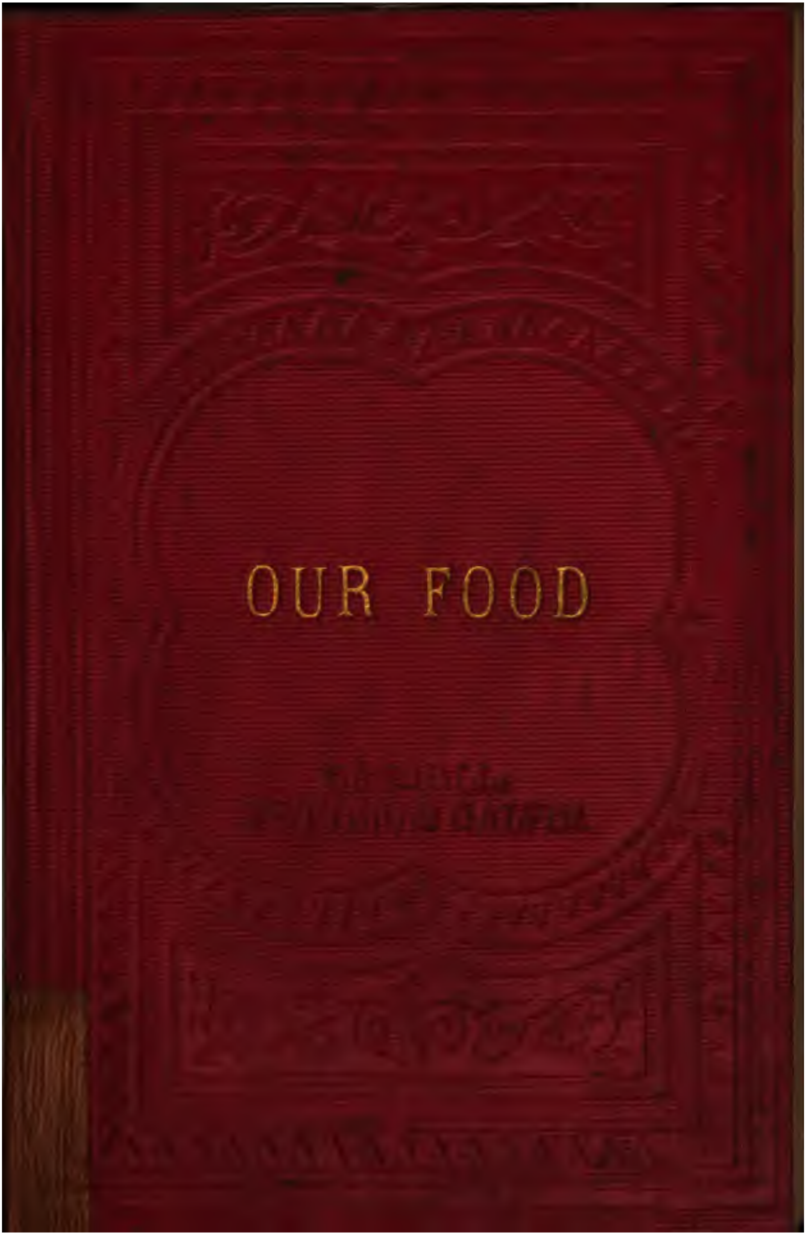

OUR FOOD

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OUR FOOD.

A USEFUL BOOK
FOR
BOYS AND GIRLS.

BY

ELLIS A. DAVIDSON,

AUTHOR OF "OUR BODIES," "THE ANIMAL KINGDOM," "THE USES OF PLANTS," ETC., ETC.

CASSELL, PETTER, AND GALPIN,
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INTRODUCTION.

THIS little work, intended for the use of Boys and Girls, follows out the course commenced by "Our Bodies," "The Uses of Plants," and "The Animal Kingdom," and aims at giving some elementary lessons in Domestic Economy.

The instruction is to a certain extent technical, in order to give to our children some information as to the sources from which we derive our supplies, and the processes involved in the production of the various articles of food.

An endeavour is also made to give some elementary lessons on the proper uses and combination of the different kinds of food; these will, it is hoped, prove particularly useful to girls, for whether they are at a future day to take upon themselves the duties of regulating the daily meals, on which so much of the health of a household depends, and in providing which so much frugality and economy are required;—whether as mistresses, nurses, or general servants, the subject must ever be an important one to females.

The lessons given will, it is hoped, cause children to think of the hundreds of thousands of their fellow-creatures employed in rearing cattle, in tilling the ground, in obtaining the fish, and in manufacturing the numerous articles used in food; and will show them how men are, by the wisdom of God, made mutually helpful whilst earning an honest subsistence for themselves and their families.

The study will bring to their minds the wonderful applications of science, by which some of our food is transported to us across the seas, or is brought to us from distant parts of the country; and in this they will be reminded that we have other duties to perform than merely in receiving what is sent to us.

Our corn, fruit, &c., may be packed as the capacity of the vessel or wagon may necessitate, but our cattle demand greater care. And when we crowd them together so that they can scarcely move or breathe, and when we deprive them of water during long journeys, we show ourselves unworthy of the trust God reposed in us when he said, "Into your hands are they delivered—every moving thing that hath life shall be unto you for food, even as the green herb, I have given you all things."

All Nature lays her productions at the foot of man, and in order that he may not lose the use of such as would otherwise be out of his reach, animals are created which seek them out for him.

The cow browses in the valley, whilst the goat feeds on the mountain-top; the fish seeks its sustenance in the depths of the ocean, whilst the bee gathers the sweet juices from the flowers around.

All bring what they have gathered, transformed by the wonderful processes of their internal laboratory, into wholesome and pleasant food for the lord of the creation.

And the plenty with which we are favoured in this happy country, should teach us to share with our fellow-creatures, as far as we can, the blessings we enjoy. In this we shall only be distributing His gifts of which we are but the stewards, for "The earth is the Lord's and the fulness thereof."

ELLIS A. DAVIDSON.

London, 1870.

OUR FOOD.

CHAPTER I.

Why we Take Food.

How many boys and girls when they sit down to take their meals, think of the reasons why they are obliged to eat?

They know that they feel hungry, that they are glad when they are called to their nice breakfast or their good dinner—and it is very likely that they will enjoy their food all the more if they know something about it.

This knowledge will prove of service throughout your whole life; for it will teach you *what* to eat, *how much* to eat, and *when* to eat: so that the good things which God has given you may not be taken in too great quantities, or when they would not be fit for you.

You will learn what food is best to be taken by each person, according to the work he has to do; how the different substances we use as food should be prepared or combined, so that they may be of the greatest service to us; you will then understand that food is not given for our pleasure only, but for our actual use; and you will feel the truth of the sentence : "We do not live so that we may eat, but we eat so that we may live."

You must understand, then, that from the moment of our birth, a constant change is going on in our bones, our flesh, our skin, and in every other portion of our bodies. Every particle or atom, however small, is moved away as fast as it decays, and its place is taken by new matter.

This is called the "waste and repair" of the system, and it is to make up for the waste that new material is required, which is obtained from the blood.

But you will ask, "How is it that the blood contains substances which nourish every part of the body, and whence does it obtain them?" Well then, by a wonderful process which goes on within us, the food we take is changed into blood, which then travels throughout our whole system carrying nutriment to every part.

Our food, then, if of the right kind, and if properly prepared, gives us strength ; and thus it is, that when we have been too long without food, and most of the nourishing matter which the blood contained has been drained from it, we feel hungry, and consequently weak.

But whilst some portions of the food we take serve to build up our bones, flesh, hair, nails, &c., others act like the fuel we put upon the fire—that is, they give heat to the whole system whilst the many changes are going on, so that such food may be said to be burnt up in our bodies. Our food, then, gives us warmth ; and this is why we feel cold when we are very hungry.

The removal of the waste from our system is assisted by activity and fresh air ; and this is the reason why out-of-door exercise gives a good appetite, for the moment any portion of bone, flesh, or skin has done its duty and passes away, the waste is at once supplied, and then new matter is required, to keep up the repairing quality of the blood. But idleness and laziness, by preventing the proper changes going on, cause loss of appetite, and thus in time the whole body becomes weakened.

The bear, which buries himself and takes a long nap over the whole winter, does not during that period require any food at all; whilst the canary, the blood of which is very warm, and which is exceedingly active, hopping from perch to perch, is almost always eating, and seldom passes his seed-glass without paying a visit to it.

Children require a supply of food more frequently than grown-up persons, because the changes in their bones, flesh, skin, &c., are going on more rapidly, owing to their increase in size and their greater activity. But this supply must be taken at regular hours; there is nothing so injurious to the system as constant eating, and when meals are fixed to be taken at regular hours, children should not be permitted to have cakes, sweets, or other things in the intervals, but the stomach should be allowed its proper time to act upon the food already taken before more is added.

You have been told that the various classes of food answer different purposes in our system, and thus we require a mixed diet. It seems as if nature had guided men in their taste, for somehow or other we have fallen into the habit of eating certain portions of each sort, so combined that the food thus formed becomes good for us.

"Thus," says Dr. Carpenter, "we use melted butter with most kinds of fish, or fry them in oil; whilst the herring, the salmon, and the eel are usually fat enough in themselves, and are dressed and eaten alone. A similar adjustment is made when we mix eggs and butter with sago, tapioca, and rice; when we add oil and the yolk of egg to salad; when we boil rice with milk, and combine cheese with maccaroni. Even the morsel of butter or the bit of cheese which the English labourer eats with his hard-earned bread, are not matters of luxury, but of really positive importance; and the existence of these tastes and habits shows how, by long experience, man has at last learned to adjust the composition of his food so as best to maintain his health and the vigour of his body."

CHAPTER II.

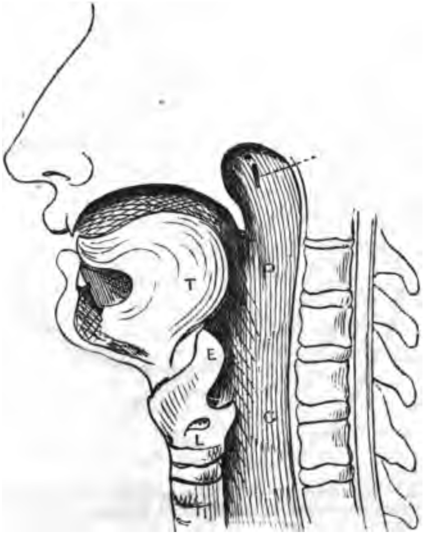
How we are Nourished by our Food.

The process by which food is turned into matter fit to mix with the blood is called **Digestion.**

When we place the food in our mouth it is **Masticated** or chewed, during which process it is moved about by the tongue, and is moistened by the liquid called **Saliva,** which flows into the mouth from six glands called the **Salivary glands.** These glands are sponge-like masses made up of very small cells and tubes: two of them are placed inside the cheek, near the ear, two are under the jaw, and two are under the tongue.

The moment food is placed in the mouth, the saliva begins to flow; in fact, it pours in even at the thought; and this is what people call "making their mouth water."

From the mouth, the food passes down the throat, into the lower end of the passage called the Gullet, which you will see marked with the letter G in the engraving. As it moves downward it has to pass the **Larynx,** or windpipe, and would be likely to fall into this opening were it not prevented doing so by the larynx being drawn under the base of the tongue and covered by a little flap called the **Epiglottis** (E).



It is very dangerous to talk whilst you are swallowing food; for if a morsel "goes the wrong way," that is, passes into the larynx instead of into the gullet, violent coughing takes place, and if this did not force it up again you would be suffocated. This may also happen in eating too hastily.

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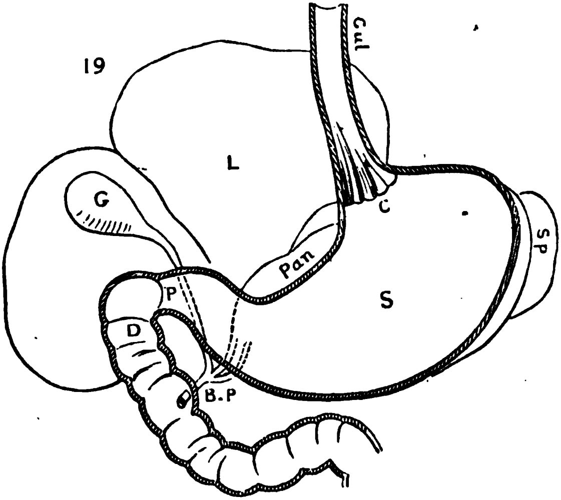

S. Stomach. **Gul.** Gullet. **C.** Cardiac opening, through which the food enters the stomach. **P.** Pylorus, through which the food, partly digested, passes out of the stomach. **Pan.** Pancreas or Sweetbread. **L.** Liver. **G.** Gall-Bladder. **D.** Duodenum. **B.P.** Bile and Pancreatic Juice entering at the same duct. **Sp.** Spleen.

From the gullet, the food passes into the stomach—which is a bag broader at the upper end than at the lower—the opening through which the mass enters is called the **Cardiac orifice.** The annexed drawing will show you the position of the various parts, and you will find further information in the little volume of this series called "Our Bodies."

The entire inner side of the stomach is covered with little cells, or cups, which gather a peculiar fluid called the **Gastric Juice**; this pours into the stomach and mixing with the food as it moves about dissolves it.

Now only just as much gastric juice enters the stomach as is required to act on the quantity of food which is necessary for the proper nourishment of the system; and as a certain time is required to dissolve the different kinds of food we take, you can very well understand how wrong it is to "bolt" your meals—that is, to keep on putting more food into your mouth before you have properly masticated what is already there; for by this means you not only send more matter down into the stomach than can be acted upon at once, but you swallow it in large pieces, which take much longer time to dissolve than food which has been ground up by the teeth and moistened by the saliva. Thus a mass of undigested matter has to be detained in the stomach until some portion is dissolved and moved away, meanwhile causing great pain and inconvenience.

When any portion of the food in the stomach is dissolved, it is allowed to pass out by an opening called the **Pylorus**; it is then a liquid, rather thicker than cream, and is called **Chyme.** This liquid enters the first portion of the small intestines called the **Duodenum** (D), and is there mixed with pancreatic juice which flows from the pancreas (P), and with bile which flows from the gall bag (G B). Another juice also, called the **Intestinal**

Juice, mixes with the chyme at this point, and then the chyme is changed into **Chyle.**

This chyle, then, is called the "proceeds of digestion," because it contains all the nourishment which has been drawn from the food we have digested. And now another set of vessels become necessary, in order that the juices formed may be *absorbed*, or sucked up, and carried forward to be changed into new blood.

The first of the sets of vessels is called the **Lacteals**, which arise in the lining of the small intestines. They are very small tubes, and their walls are so very thin, that the fluid in the bowels, which is something like milk in appearance, passes through them into the lacteals and several glands belonging to them.

Now you must understand that just in front of the spine there is a tube or canal called, the **Thoracic Duct.** This is widened into something like a pouch or bag at its lower end, and into this the lacteals pour the chyle.

Meanwhile, another set of vessels, called **Lymphatics**, have been at work gathering another fluid called "lymph." This they suck up from all the various parts of the body through which they travel; this, also, is emptied into the same pouch, and then the mixture passes upward and is poured into a large vein in the neck, and from there it flows direct to the heart. From the heart it is forced into the lungs, together with the blood which has already circulated in the body, to be purified, and to receive a new supply of fresh air. The blood then returns to the heart, and is thence forced through tubes called **Arteries** over the entire body, carrying the nourishment which has been gathered from the food we have taken into every part, however distant; and thus the tissues are renewed, for, as the blood returns, it brings with it some of the used-up matter; and this process of waste and repair is continually going on.

CHAPTER III.

Of Food Generally.

THE effect of the gastric juice on various substances has been observed in a remarkable manner. Some years ago a young Canadian, named Alexis St. Martin, met with a very severe accident by the bursting of a gun, and the wound thus caused never completely healed. Through this some of the gastric juice was drawn off for the purpose of watching its action on the several kinds of food. These and other observations have now made it clear that of food derived from animals, venison is the most digestible—that is, it takes the least time to dissolve; then turkey; next, feathered game, such as pheasants, &c.; then chicken, mutton, beef, veal, and, last of all, pork.

Vegetables take longer to digest than meat, and thus we find that in cows, and other animals which live on grass and roots, the food-canal is very much longer than it is in the lion and other animals which live entirely on flesh.* This is to give greater time for the nourishment to be drawn out of the vegetables. We prepare our food for digestion by cooking, and mixing it in the different ways which experience and science have taught us to be the most agreeable and at the same time the most useful to us.

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* See "The Animal Kingdom," Cassell's Primary Series.

The gastric juice pours into the stomach when solid food comes in contact with the little cells in which it is formed, and thus we see that liquid food, such as soups, are not, by themselves, fitted to sustain us, although they may contain a great deal of nutriment. Savage nations seem to have picked up this knowledge by their own experience. Thus the people in Kamschatka, whose principal food is train oil, mix earth or sawdust with it, and so make a sort of pudding, which I do not suppose you would like to taste; and the wild hunters of Ceylon grind up soft and decayed wood, which they mix with the honey they eat. One of these was asked why he did this, and he said, "I cannot tell you; but I know the stomach must be filled."

Of course, the exact quantity of food required for the sustenance of the human body must depend on the age and habits of each person, and the amount of exertion he may have to undergo; but from observation of numerous bodies of healthy men, such as soldiers, sailors, &c., it seems that from two pounds to two pounds and a half of proper food is found to be sufficient. It has also been proved that a moderate meal takes about four hours to digest, and therefore a longer time than this should elapse before more food is taken, in order to allow the digestive organs a certain period of rest.

This is more important to you than you might think. God has, in His goodness, given us the privilege of selecting our food from any one of the many sources which He has opened for us, and we are enabled to make our food pleasant to the taste, so that we may be induced to take it as the necessary sustenance of our bodies, but we must guard against eating for the mere pleasure of eating. Our organs are arranged to do a certain amount of work, and if we overtax them they will sooner or later be injured, and suffering of every kind will be the result.

I have told you, not only in this book but in another ("Our Bodies"), that the blood passes from the heart to the lungs to be mixed with fresh air. Now the drawing in of pure air takes place when the membrane which forms the floor of the chest sinks downward, but it is prevented doing this when the stomach, which is immediately under it, is too full. Consequently, when the blood enters the lungs there is not any fresh air to act upon it; it is still forced onward, and thus passes again into the system without being purified; still it proceeds, gathering more impurities, and thus headache and sickness, and in time permanent diseases, set in.

According to the best writers on this subject we find that each seaman in the British Navy is allowed from 31 to 35½ ounces of nutritious food each day, of which about 26 ounces are derived from vegetables and the rest from animal substances; namely, 9 ounces of salt meat, or 4½ ounces of fresh. Sugar and cocoa are also given. Soldiers are allowed a pound of bread and three-quarters of a pound of meat. In most hospitals, the food given to patients who are recovering, and who require strengthening diet, consists generally of half a pound of meat, from 12 to 14 ounces of bread, half a pound of potatoes, and a pint of milk, with such beer or wine as the doctor may think necessary.

You will see that the food allowed for soldiers and sailors is arranged for men who are to go through great bodily exercise, and who may have to endure great fatigue; whilst the other is adapted for persons who have been weakened by sickness. And now let us compare these quantities with those allowed to persons in workhouses and in prisons.

In the union workhouses of England able-bodied men obtain about 25 ounces of solid food daily, including about 5 or 6 ounces of meat. In prisons, it has been found necessary to give a certain amount of meat to prisoners who are subject to hard labour, and as a rule the amount of food given seems to be 36 ounces per day, of which only a small portion is animal food—viz., about 16 ounces per week.

The amount of food, then, which experience shows to be necessary to maintain health seems to be from 25 to 35 ounces per day, and of this a fourth or a fifth part should be animal food. Food should be varied, as said before, according to confinement, exercise—youth or age—and must, of course, be arranged according to sickness or health.

The smallest amount of food known to have supported life is that on which a Venetian nobleman, named Ludovico Cornaro, existed for a period of fifty-eight years. He was born in 1467, and the latter portion of his life offers an important example of what may be done by temperance.

His constitution having become weakened by intemperate eating and drinking and other excesses, so that at the age of forty there was but little hope of his life being prolonged, he determined to adopt rigid rules of temperance, both in meat and drink; this with proper exercise seemed to restore him to health, and he lived to be nearly 100 years old. During this period, his diet consisted of 12 ounces of food, principally vegetables, with 14 ounces of light wine daily. His old age was remarkably cheerful, and to promote the habits of temperance which had proved so beneficial to himself, he wrote (in his eighty-third year) an excellent "Essay on Temperate Living," which was first published in Padua in 1558, and which has been translated into almost all European languages.

In contrast to this may be mentioned instances recorded by Arctic travellers of the immense amount of food which can be taken by the inhabitants of these cold regions. Sir John Franklin, in his account of one of his first voyages, tells us that, wishing to see how much an Esquimaux boy could take, he gave him permission to eat some of his tallow candles, for which he had shown a liking. The boy soon set to work with a right good will, and had eaten *fourteen* pounds of the candles, when Sir John, fearing that if this went on he would have to spend many of his evenings in darkness, gave him a lump of fat pork to finish his treat. The Cossacks of Siberia are said to take from 12 to 20 pounds of animal food daily.

CHAPTER IV.

Of the Different Kinds of Food.

THE food we take has been the subject of much study by chemists, and has been classified in various ways. The simplest arrangement is here given, so that you may comprehend the general subject, and thus be enabled to enter further into the subject at a future time. For present purposes it will be sufficient to divide all food into four groups, viz. :—

NUTRITIOUS OR FLESH-FORMING FOOD—viz., Albumen, such as the white of egg. Fibrine—the substance found in the blood of animals, and in many plants, and which forms the muscular tissue. Caseine—the substance which we separate from milk, in the form of cheese, and which exists in peas, beans, &c., under the name of Legumin.

HEAT-GIVING FOOD.—Starch—Sugar—Fat—Oil.

MINERAL FOOD.—Water—Salt—Ashes of plants and animals.

ACCESSORY (or helping) FOODS.—Gum—Gelatine—Cellulose—Spice-Oils—Tea—Coffee.

We will now proceed to speak of

Nutritious or Flesh-forming Foods.

These foods are called **Nitrogenous,** because they contain not only the three chemical Elements called Oxygen, Hydrogen, and Carbon, but Nitrogen as well.

These four elements are called *organic elements,* because they are found to exist in the organs or growing parts of all animals and plants, and therefore, when by means of the digestive process, which has been already described, these are taken into the blood, and are carried over the whole system, they convey to every part the necessary material for forming muscle or flesh, and nerves, thus enabling the body to grow and to repair the waste which is constantly going on. Without these foods, then, life could not be supported, as the whole body would wear away.

Just in the same manner as the fire goes out unless we put on fuel, so does the matter of which the muscles and nerves are made become used up, and require material to be supplied of which they may be renewed. "We think (says Dr. Lankester) by aid of our brain, of the nervous matter of which it is composed—and in this way every time we think, we exhaust or destroy a certain portion of nervous matter, and if we went on thinking, if we went on feeling and perceiving—exerting this nervous system—the nervous system would at last become entirely exhausted, unless new material replaced the old ones that were used."

The substances of which the nerves and muscles are formed are brought to them by the blood in the arteries, and the waste of these tissues is thrown back into the blood which the *veins* are carrying back to the heart to be cleansed and restored, as you have already been told.

Thus, suppose a man going to his work in the morning without having taken any breakfast, and going on all day without any food; as the day advances he becomes more and more faint and weak; he cannot work well; he cannot think clearly; and if this were to go on, he would die from starvation.

Here, then, lies the necessity for taking food—the materials of which we are composed are constantly passing away, and require replacing.

You have, of course, noticed that animals throw off parts of their body at certain seasons of the year, and we call that "moulting." We apply the term to the periodical casting off of the feathers, hairs, &c. Crabs and lobsters throw off their shells altogether; birds, their feathers; horses and other animals, their hair; but in human beings this process of moulting is going on continually. Our skin rubs off, our mucous membrane* wears away, and our internal organs disappear by a similar process, so that it is calculated that a human being loses about the fortieth part of his weight every day, and that thus the vital organs of the body are renewed every forty days.

You may perhaps think it strange that you do not see this change as it goes on—that you do not see a boy without a finger, or ear, or nose; but you must understand that this change goes on little by little and constantly—that each *atom* is at once replaced, so that there is no vacancy.

You can imagine a bricklayer working in this way; supposing a wall is gradually decaying, but cannot be spared whilst being rebuilt, he might take out one brick and put in another, take out the next brick and again put in another, so after a while not a single brick of the old structure would remain, and yet the wall has not been removed bodily, but only changed. If you can further imagine that at the same time more bricks are added, you will understand how it is that the bodies of children become larger during these changes.

The waste, then, is caused by the wearing away of our bones, muscles, and nerves, and the materials for their repair are supplied, not by starch, sugar, or fat, but by the **flesh-forming foods**, of which I will now speak.

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* See "Our Bodies," page 97.

The three forms in which we take flesh-forming foods are **Albumen, Fibrine,** and **Caseine,** and these are found in both the vegetables and the meat we eat; they exist, however, in the first instance in the vegetable world; then the ox and sheep eat the grass, or the hay or oats, and the flesh-forming portions of the plants go to build up their bodies, which we afterwards eat; so that, when the cattle are feeding in the fields, or lying munching over the grass they have first swallowed and have then brought up again to be properly masticated,—when the lambs and sheep are cropping the fresh grass high up on the slopes of the mountains, as we often see them in Wales, they are all of them doing God's bidding in preparing food for man.

Albumen.—This substance is well known to you in the form of the white of egg. Its use in our bodies is principally in forming the nerves and brain. It is found also in the blood of animals: for you know I have told you that all the substances which are to repair the waste in the different parts of the system, are carried there by the blood.

Albumen also exists in plants—such as rye, wheat, &c.—and in these there is another flesh-forming substance called **Gluten,** of which I will tell you presently. Asparagus, carrots, turnips, cabbage, and several others contain albumen; but potatoes contain very little of it.

Of course, you will have observed that when an egg has been boiled for more than a minute or so, it gradually hardens, and this will show you that *heat hardens albumen;* and you will see that, if you have a nice soft-boiled egg for your breakfast, you must not drink too hot tea, because that would harden the egg in your stomach just the same as it would if you poured hot water on it in a cup; and I need scarcely tell you that hard-boiled eggs are very indigestible.

But albumen is also hardened by certain acids—one of which, called Tannic Acid, is contained in tea, and therefore the tea taken with eggs or with meat should not be too strong, or it will harden the food. Many persons of weak digestion are forbidden to take tea for this reason.

Albumen is congealed and thrown down from the liquid in which it may be dissolved, by spirits. Thus, when brandy, gin, whiskey, or other spirits enter the stomach, they cause the albumen which is there to separate from the other matter and to fall to the bottom, and thus the use of it is lost. Now I have already told you that it is this albumen which goes to form the substance of the brain and nerves. These vital portions of our system are thus robbed of their nourishment; the miserable victim of drunkenness becomes nervous, weaker and weaker, his hands shake, his mental powers decline, and he sinks from that glorious place in creation to which God had assigned him, and becomes a misery to himself and all around him.

Fibrine.—Fibrine may really and truly be called a flesh-former, for it is the substance of which our muscles (or flesh) and those of other animals are composed. It is the fibrine in blood which causes it to congeal or become solid. It is contained not only in animals but in plants: we eat it in wheat, oats, rye, rice, and numerous other plants, but the fibrine when occurring in plants is called **Gluten,** which I have already mentioned to you.

You can in a very simple way obtain gluten from flour. Mix the flour with a little water and knead it until it becomes dough. Tie a piece of muslin over the top of a tumbler, and pour water over the dough whilst you knead it. The water which will run through into the glass will look something like milk, but, after a while, a white powder will settle to the bottom—this is **Starch**—the sticky matter which will remain in your hand will be **Gluten**, and it is this substance which builds up and repairs the continual waste in the muscles of our bodies.

The third flesh-former is **Caseine**. This is the substance which we separate from milk by means of the acid contained in rennet (the stomach of a calf) and form into cheese. You have, no doubt, tasted curds and whey. Well, the curd is the caseine, which by means of an acid is gathered from the milk in which it was contained.

But we obtain large quantities of a similar substance from plants, and then we call it **Legumin.** It exists in all the pea and bean kind, and therefore the whole order to which they belong is called the "Leguminous," and of these I shall speak presently.

I will give you an idea of the quantity of nutritive matter we obtain from the plants I have alluded to. Supposing you had 100 lbs. of rice, there would be in it 6 lbs. of nutritive matter; in 100 lbs. of cocoa-nibs there would be 10 lbs.; in the same quantity of maize there would be 11 lbs.; in wheaten flour, 13 lbs.; in barley meal, 14 lbs.; in oatmeal, 18 lbs.; in dry peas, 23 lbs. This is called so many per cent., which means so many in a hundred. Caseine and legumin are not, however, so very valuable as you might suppose from the great amount of nutritive matter they contain. This is because when the legumin or caseine is separated from the fluid in which it people in England, Wales, and Scotland require about six bushels each in the year. Not that we eat all that quantity; some of it is saved for seed for the next year, and some is made into starch, which you know is used in stiffening linen, and also in the manufacture of cotton fabrics, so that you see we get the benefit of it in more ways than one.

We import about forty-two millions of bushels per year, and we grow about one hundred millions of bushels at home. The wheat we import, comes to us principally from America, Prussia, and other parts of Germany, Russia, France, Northern Africa, the East Indies, Australia, &c.

Wheat is considered the best of the food grasses, because it contains the largest quantity of flesh-forming material. By means of careful sifting, all the husk or bran is separated from the inner portion of the seeds, and thus the very fine white flour is obtained; but the bran contains more nourishment than the flour, and therefore the coarser, darker bread is really the most wholesome and the most nutritious.

Have you ever been to the South Kensington Museum? If not, the sooner you go there the better. You will find in that beautiful place, not only some of the most wonderful works of art that have ever been produced in the world, but you will also find an Educational Department, in which are placed all sorts of models, books, and pictures used in teaching; one of the most important and useful branches of the Museum is the "Food Collection." In this, the various articles which we daily eat are arranged in their proper classes, with descriptions of each; and these descriptions, not only tell you what the article is and where it comes from, but also show you the separate substances of which it is composed. This is done by what is called "analysis."

Now in one of the cases we find wheat, and the exact quantity of each of the substances contained in one pound of it; and we are told that 21 ounces of wheat are required to make 1 pound of flour; the remaining 5 ounces being the bran, or outer and inner skins of the husk.

THE INGREDIENTS (OR SEPARATE SUBSTANCES) CONTAINED IN ONE POUND OF FLOUR ARE AS FOLLOWS:—

	ozs.	grs.
Water	2	106
Gluten	2	21
Albumen	0	126
Starch	9	242
Sugar	0	385
Gum	0	119
Fat	0	84
Fibre	0	119
Ashes	0	112

These can be reduced to

Carbon	7	0

"The proportion of flesh-forming matters to those which produce force only, are more nearly adjusted to the requirements of the system in wheat than in any other food. Hence, probably, its very general use as an article of food amongst the populations of the hardest working-men in the world."

In making bread in England, we use the finest flour to make the "firsts," or white loaves. The next is made into "seconds," or "household bread," and that which is still coarser is made into "thirds." There is no bran in the firsts; but there is some in the seconds, and more still in the thirds; and I have told you that bran contains more nutriment than the flour, so you will see that it is absurd for people to grumble at "coarse bread," which is more nourishing and more wholesome than the finest quality.

How Bread is Made.

In the first place, the baker takes the quantity of water which he knows he requires, and mixes with it some yeast and salt. After this he adds the flour, and then the whole mass is thoroughly well kneaded until it is of the right degree of solidity.

It is then called "sponge," and is placed in a large pan or kneading-trough in a warm place; this is called "setting the sponge."

Presently the yeast begins to act on the gluten, starch, and sugar of the wheat, and a sort of gas, called "carbonic acid gas," is formed in every part of the dough; this is set free in bubbles, and, as these expand, they cause the mass to "rise;" and it is these air-cavities which you see in bread which would otherwise be solid and indigestible.

The change which takes place is called "fermentation," and when this has gone on long enough, the baker takes the dough, adds more flour, water, and salt, and kneads the whole up again, allowing it to stand for a few hours.

By this time the dough has swelled out a great deal; it is now divided into the proper-sized lumps for the loaves, which are allowed to lie for a short time, during which they swell out again.

These loaves are now placed in the properly-heated oven, sometimes in tins, and sometimes on the floor; the door is then shut. The length of time they remain in, must, of course, depend on the heat of the oven, and of this the person who bakes will be the best judge.

The brown appearance and pleasant taste of the "crusty loaves" are caused by the action of the heat on the starch.

The number of "quartern" loaves (4 lbs.) which a sack of flour, weighing 280 lbs., yields, is 90, so that you see there must be 80 lbs. of water in the whole quantity.

ADULTERATION OF BREAD.—Bread is frequently adulterated, that is, the flour is mixed with other substances so that more profit may be made by selling it. Very often boiled potatoes are mixed with the dough, because potatoes are cheaper than wheat; sometimes alum is mixed to make the bread whiter than it would otherwise be: and often other substances are mixed which are by far more injurious than these. Still it is dishonest to mix even potatoes with the dough, for, although they are not hurtful, they do not contain anything like the quantity of nutriment which would exist in the same weight of wheat, and therefore the purchaser of such bread is cheated.

Some very important laws have been made in relation to bread; thus, after stating that "bread may be made of flour or meal of wheat, barley, rye, oats, buckwheat, Indian corn, peas, beans, rice, or potatoes, or any of them, or with any common salt, pure water, eggs, milk, barm, leaven, potato, or other yeast, and mixed in such proportions as bakers may think fit, and with no other ingredient or matter whatsoever," the laws say:—

1. "No baker shall in the making of bread use any mixture or ingredient whatsoever other than those above mentioned, under a penalty for every offence, not exceeding ten pounds, nor less than five pounds, with the alternative of imprisonment with

or without hard labour, for any time not exceeding six calendar months; and the offender's name, place of abode, and offence, may be published in the local newspapers."

2. "Any person adulterating corn meal or flour, by the introduction of any ingredient not being the real produce of the corn or grain, or any person selling meal or flour of one sort of corn as the meal or flour of another sort, whether separate or mixed, shall forfeit or pay, according to the discretion of the magistrate or justice, a sum not exceeding twenty pounds nor less than five pounds."

3. "Magistrates or justices of the peace, and also peace officers authorised by warrant, may, at seasonable times in the daytime, enter a baker's premises, and search for adulterated flour or bread; and if any be found, the same may be seized and carried with all convenient speed to the nearest resident magistrate or justice of the peace, to be disposed of as he may think fit." The penalties varying from £2 to £10.

The laws also provide that, with the exception of French rolls, fancy bread or rolls, all bread must be sold by weight, and in no other manner, under a penalty not exceeding forty shillings, and bakers must use the avoirdupois weight under a penalty of from £2 to £5. For this purpose they must provide in their shops, on or near the counter, a beam and scales, with proper weights or other sufficient balance, in order that the same may be weighed in the presence of purchasers.

This regulation also applies to the delivery of bread by cart or other conveyance, and thus the baker is bound to have scales in the cart, so that the bread may be weighed as it is handed in.

Neglect of this law subjects the baker to a penalty of five pounds.

You will see from this how wisely our laws are framed, so that equal justice may be dispensed to all, and from this specimen you will form a good idea of other laws: you will thus learn to honour the institutions of our country, and to obey the laws under which we enjoy such happiness and prosperity.

Bread which has been made with yeast is called "leavened;" but in the East this is not usually done. The flour is merely mixed with water, and the paste made into thin cakes. This is, no doubt, because so many of the Eastern nations are what are called "nomadian;" that is, travelling about from place to place; so that they do not find it convenient to let their dough "rise," which you have seen takes several hours. Thus we find when the children of Israel were escaping from the Egyptian bondage, "they baked unleavened cakes of the dough which they had brought out of Egypt, for it was not leavened; because they were thrust out from Egypt, and could not tarry."

Vermicelli is made of a particular sort of wheat which is grown in Italy. The Italians force the dough through very small holes, and in this way they make the fine threads which we eat in our soup. **Maccaroni** is made in a similar manner. It is passed through larger holes, in the middle of which a wire is fixed; so that the maccaroni becomes hollow like pipes. In some parts of Italy men stand about the markets selling the boiled maccaroni, and the common people often try which can swallow the greatest lengths of them.

Before maccaroni is sent over to this country, it is broken into convenient lengths.

CHAPTER VI.

Flesh-forming Food obtained from Plants (*continued*).

Oats.—The oat is a much hardier plant than the wheat, and thus it ripens in more northern climates than the wheat would do. We find it flourishing in Norway, where cakes called "Knackebroe" are made of it. The oat grows best in moist and cold countries: great quantities are produced in Scotland, and the Scotch oats are considered the best quality.

OATS.

The Oat is very well suited for human food, as it contains the flesh-forming, heat-giving, and mineral matters which we require. The flour of the Oat cannot be made into bread; but it is eaten in the form of oatcakes, which are very nice; and the oatmeal is, as you know, made into porridge or gruel, which, when made with milk, is very nice and wholesome. Oatmeal and oat-cakes are not, however, as digestible as wheat-flour or wheaten bread; the bran of oats does not contain as much nourishment as that of wheat, and therefore the oatmeal is better for food than the whole oat; but it is very strengthening, and therefore, for persons engaged in out-of-door work it is very economical food.

We use a great quantity of oats in the United Kingdom. We grow about twice as much as we do of wheat, and still have to import some. But, although I say we use all this, I do not mean that *we* eat it; but we use the greatest part of it for food for our good friends the horses, and it is also given to sheep and oxen; the straw, too, is very useful as fodder for cattle, and therefore obtains higher prices than other straw.

The case in the Food Collection in the South Kensington Museum contains:—

ONE POUND OF OATS. ONE POUND OF OATMEAL.

	ozs.	grs.
Water in 1 lb. of oatmeal	2	78
Albuminous matter in 1 lb. of oatmeal .	2	316
Starch in 1 lb. of oatmeal . . .	6	153
Sugar ,, ,, ...	0	378
Gum ,, ,, ...	0	210
Fat or oil ,, ,, ...	0	397
Fibre ,, ,, ...	2	6
Ashes ,, ,, ...	0	210
Carbon ,, ,, ...	6	348

Barley.—We do not use as much barley for food as we did formerly. Barley-bread was once the common food of the poorer classes, and barley-cakes are still eaten in the North of England. We obtain from barley the following preparations:—Scotch barley, Pot barley—of which a kind of broth is made in Ireland and Scotland—Pearl barley—which you know we use in "barley broth."

The various substances found in 1 lb. of barley are exhibited in the Food Collection as follows:—

ONE POUND OF BARLEY.

	ozs.	grs.
Pot barley obtained from 1 lb. of barley .	11	0
Water ,, ,, ,, ,, .	2	106
Gluten ,, ,, ,, ,, .	2	22
Starch ,, ,, ,, ,, .	7	297
Sugar ,, ,, ,, ,, .	0	265
Gum ,, ,, ,, ,, .	0	258
Fat ,, ,, ,, ,, .	0	20
Fibre ,, ,, ,, ,, .	2	50
Ashes ,, ,, ,, ,, .	0	293
Carbon ,, ,, ,, ,, .	6	0

The greatest quantity of barley is, however, consumed in making spirits and beer; for this last purpose the barley is wetted, and heaped together on floors: the heat and moisture cause the grain to sprout, and it is then termed **Malt.**

BARLEY.

RYE.

Rye is another of the grasses from which the people in the North of Europe derive much wholesome and nutritious food, and they could get more, but they choose to waste immense quantities of it in distilling gin, whiskey, and hollands. Some people say that they have become frightened out of the use of rye, because it is subject to a disease which causes some of the grains to swell, turn black, and become poisonous—*yet they turn the rye into spirits, with which they poison themselves;* so you see their argument is nonsense.

Besides, there is no danger of people being poisoned now by the ergot of rye, as we have improved methods of cultivating and cleansing the grain. The ergot is, however, an important medicine in the hands of the physician.

The following are the

INGREDIENTS CONTAINED IN ONE POUND OF RYE, AS EXHIBITED IN THE FOOD COLLECTION.

	ozs.	grs.
Water in 1 lb. of rye	2	35
Gluten ,, ,,	1	318
Albumen ,, ,,	0	213
Starch ,, ,,	8	79
Gum ,, ,,	0	371
Sugar ,, ,,	0	262
Fat ,, ,,	0	66
Fibre ,, ,,	1	284
Mineral matter in 1 lb. of rye	0	122

Maize is another of the grasses yielding food—not only for man, but cattle. It does not contain as much flesh-forming matter as wheat, but more fat, and a great quantity of starch. It is therefore considered very fattening; and is much used as an article of food in the place of arrowroot.

Maize is generally known by the name of Indian Corn. It is supposed to be a native of the warmer parts of America, for when Christopher Columbus discovered America he found the natives growing it. He introduced it into Spain in 1520.

The grains of maize make a very palatable kind of groats, and afford an excellent meal for baking purposes, but owing to the deficiency of gluten, it is not adapted for making bread without a mixture of wheat-flour or rye. The meal of maize mixed with rye-meal forms the common brown bread of New England—maize very coarsely ground and boiled forms the "hominy" of the Southern States of North America; the porridge made of maize meal is called "mush" in North America, and the entire grains are used under the name of "hulled corn," or "samp." The unripe grains, when exposed to heat over a charcoal fire or gas for about two minutes, burst and turn inside out, increasing immensely in size, and assuming all sorts of queer shapes: this is called "pop-corn," and is a very favourite article of food in America. Recently it has been introduced into London, and may now be purchased at shops. Pop-corn is either eaten just as it is made, or it is sweetened and flavoured as a dessert biscuit.

Maize first became general in England during the potato famine in 1846, and there is now such a general demand for it, that about two millions of quarters of it are imported, principally from the ports of the Black Sea and the Mediterranean.

A beautiful preparation called "Corn Flour" is now sold; it is the flour of the maize, from which the gluten and the husk have been separated. It is said to be superior in many respects to arrowroot, and yet is cheaper.*

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* For illustration of maize, and further account, see "The Uses of Plants," page 19.

The Bread Fruit is the produce of a tree growing in the islands of the Pacific Ocean. You will find an account of it in "The Uses of Plants," the space at our disposal here not permitting any more than the mere mention of it.

CHAPTER VII.

Leguminous Plants.

Peas.—I have already told you (page 29) that peas and beans contain a great quantity of flesh-forming matter, like caseine, and that this is called *Legumin:* from this the whole family is called "*Leguminous.*"

So much caseine, in fact, do peas contain that the Chinese make some very good cheese from them.

The pea family is known in almost every part of the world, and from some of the plants belonging to it we derive great benefit, not only in food, but in trade and medicine.

Peas generally go by the name of **Pulse,** and no doubt many of you have seen both kinds of them which are grown in England—the garden pea and the field pea. The garden pea is the one which yields us our delicious "green peas." It is a very pretty plant, which is sown in rows, and as it grows up the gardener fixes branches of trees called "pea-sticks," which he cuts from the hedges, and the peas climb up these, twining around all the branches, and forming lovely green walls. By-and-by the flowers come out, purple, pink, and white, and when open look like so many butterflies—in fact, their

Latin name is derived from that of a butterfly. The flowers are, as you know, followed by the peas, which are at first only very thin and small, but which afterwards increase in size, and fill out as the peas in the pods become larger.

We cannot have fresh green peas all the year, and, therefore, great quantities are dried, and sold as whole and split peas, of which we make our pea-soup during the winter months.

Besides being one of our most important crops, peas are largely imported into Great Britain, the quantity sometimes reaching 120,000 quarters. We receive them from Denmark, Prussia, the Hanse Towns, Holland, Morocco, United States, British North America, and of these our North American colonies send the greater part.

Peas are so rich in flesh-forming matter that they are more wholesome when mixed with less nutricious food, like the potato; and you will, therefore, see that it is not necessary to use great quantities of meat in making pea-soup.

Now this is not a cookery book, but it is intended to be useful to girls, who, as a rule, will have to prepare the food, as well as to the boys, who are to eat it; and you can understand how much of the comfort, nay, the health of an entire household, depends on the way in which the food is prepared. Besides which, none of us know where we may be placed or how we may be situated at any future time. We may be emigrants, and however successful, may not, at the moment we are hungry, be able to conjure up a dinner just by ringing a bell. And further, knowledge of any sort is not a trouble to us, but may often enable us to be of service to others, and therefore, I am going to tell you how to make good pea-soup in the cheapest way.

Put the peas to soak in a basin of water the night before you want them; they may be split or whole, but the split are most generally used. Now, if you have saved the water in which some meat has been boiled, it is the best liquor you could have for making your soup.

Put the peas into it, together with some carrots cut in slices, and set the saucepan partly, but not entirely, over the fire, so that the soup may simmer, *but not boil,* for about three hours; then add turnips, celery, leeks, or any other vegetable you like, and let the whole simmer again for an hour or two longer.

If you do not happen to have any meat-liquor, you can buy a few fresh beef or mutton bones at a butcher's, and these boiled with the peas will make an excellent soup.

When ready, serve in a tureen. Toast some bread, cut it into pretty little pieces, and place on the table; also some mint, chopped very fine, for those who like it. You will find that when your brothers and sisters begin to see the bottoms of their plates, they will look very anxiously towards the tureen, as if they wished to know what their chances might be of a further supply.

A pint of peas will make about two quarts of good pea-soup.

Beans.—One of the most generally used kinds of beans is that called the *Windsor* or Broad bean, which I have no doubt most of you have often seen and eaten. You know the shells are large, and when we open them the broad white beans lie inside fitted in a velvet-like padding, and they are as big as farthings, or bigger, and very much thicker. There is a great deal of nutriment in them, but I must tell you that the white skin in which each separate bean is wrapped is very hard and indigestible, so that you ought not to eat it: the bean inside this is green, and when properly boiled is very nice.

Next we have the *kidney* bean, or as we sometimes call it the French bean, whilst the French people call it *haricot.* We import great quantities of the white haricot bean from America and other countries. In the South of Europe, and as far north as Germany, in the United States of America, and many other countries, the kidney bean is a field crop, and the ripe seeds are an important article of food. Within the tropics it is sown at all seasons, but in countries subject to frost, only in spring, after the danger of frost is over.

Lentils.—The large lentil which we receive from France is made into soup in the same way that peas are. It is much grown in the South of Europe, Egypt, and the East, and to some extent in other parts of the world. Lentils contain an uncommonly large amount of nutriment, and are more digestible than peas. It is from the meal of these that the article sold as "Revalenta Arabica" is principally made.

And now for another lesson to the little girls.

Lentils, which are not as generally used in England as they ought to be, may be cooked in the same way as other pulse, to form a very nourishing and wholesome dish. They are best when large, but not too old; and should, like all beans, be boiled in salt and water till tender; and it will improve them if they are put into a basin of cold water to soak on the previous night. They may after boiling be either stewed with gravy or may be mashed with butter or gravy.

CHAPTER VIII.

Of Food derived from Animals.

I NOW come to speak of the food we obtain from animals, and must in the first place tell you about milk, because milk is what is called the "type" or model of all food, for you know that our babies, and the young of all animals called "mammalia,"* live entirely upon it for many months, and during that time they grow very fast, and it is therefore clear that they must obtain from it all that is required for forming bones, nerves, and muscles, and for producing the warmth necessary in the system.

I am indebted to Dr. Lankester's excellent lectures for the following information concerning milk:

Different animals yield milk of a different composition, and we find a variety of these milks employed as food by man.

The milk of the cow is more constantly used in this country than any other, but in some countries the milk of the goat stands in the same relation to the food of the people as the milk of the cow does here. Again, in some diseases, asses' milk is taken, and thus it becomes necessary to know something of the composition of the different kinds of milk.

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* See "The Animal Kingdom," Cassell's Primary Series.

Now one pound of the milk "our babies" suck consists of

	ozs.	grs.
Water	14	41
Caseine	0	210
Butter	0	210
Sugar	0	280
Mineral matter	0	35

Or, in very plain words, it contains water, cheesy matter, butter or fat, sugar, and a little salt.

One pound of asses' milk contains—

	ozs.	grs.
Water	14	76
Caseine	0	140
Butter	0	105
Sugar	0	420
Mineral matter	0	35

One pound of cows' milk contains—

	ozs.	grs.
Water	13	333
Caseine	0	350
Butter	0	245
Sugar	0	315
Mineral matter	0	70

When it is not possible for an infant to receive the nourishment it requires from its mother, milk from the cow is generally given; but where it can be obtained, asses' milk would be better. We do not, however, keep many of these animals in this country for the supply of milk, and therefore the little that can be procured is, of course, expensive.

You will see that cows' milk contains a great quantity of caseine; in fact, you know that we make cheese from it; but so much would not be good for "our baby," so it is necessary to add about half the quantity of water and a little sugar. The milk used for infants should be quite fresh, otherwise a change will have begun to take place in it which renders it very injurious; it is also a good plan to add some flour with cows' milk, and if the little girls who read this book have at any time to take charge of a little brother or sister, they will find the following food very good and nourishing:—

Take some of the best flour, and tie it up dry, in a cloth, as you would a pudding; bake or boil it for about six hours; and when taken out of the cloth, there will be a thick crust of paste formed around it; pare this off with a knife, and it will leave a hard ball of flour inside, break this, and grate it very fine, and as baby requires food, mix a small quantity of it with milk and water, boil for ten minutes, and when cooled pour it into the feeding-bottle.

You have already been told that milk is the model of what the food of mammalian animals ought to be, and from the accurate manner in which all the different kinds of food are mixed in it, we learn—

1. That our food ought to consist of animal and vegetable substances in which there is a proper proportion of fat, starch (or sugar), and fibrine, or gluten.

2. That all solid food must be mixed with large quantities of liquid before being taken into the stomach.

Cream.—Of course, you know that when milk is allowed to stand, a thick liquid rises to the top. This is cream; and it is the oily or greasy portion of the milk which floats about in little bags made of very thin membrane: the cream, in fact, consists of little bags of butter.

Butter.—This well-known article of food is made by beating the little bags of which cream consists against each other, until the extremely thin covering breaks, and the greasy portion gathers into one large lump; the liquid which remains is then called buttermilk. The process by which this is done is called *churning*.

I have no doubt that many of you have seen butter-churning; some of you who are living in the country have, perhaps, lent a hand to your mothers at the work, but some town children may not be so well acquainted with such matters, so I will just tell them about churns and churning, in case any of them go to live in a country not so well supplied with butter-shops as London, and then such knowledge may be very useful to them. I have told you how to make bread, now for the butter.

There are various kinds of churns. The oldest form is that called the upright or plunger churn; it is like a very high tub, in which is a long handle with a sort of tray at its lower end. As the plunger is worked up and down, it beats the milk, and so makes the butter. This is, however, very fatiguing indeed, and several other churns have been invented, but in some parts of the country, and amongst cottagers who do not care about altering their mode of work, they are still used. Then there is another old-fashioned churn—the barrel-churn. This is a barrel supported by two uprights, and resting on spindles. The barrel is turned round by a handle like a grindstone. These are not now very much used in England, but some very large ones are used in Holland. This form of churn is, however, seen in some parts of the country; perhaps not in the large farmhouses, but by villagers who just keep a few cows, and who churn their milk in small quantities in the churn that has been in the family for ever so many years. And very nice butter these good people make, and very sweet and fresh it is when they bring it to your cottage-door on their way to the town on market-day. It is pleasant, too, to see how nice and clean these honest, hardworking people look, and the butter is quite tempting, —lying in the basket on fresh grass, and covered with snowy white cloths, sometimes surrounded by a border of *really new-laid* eggs—another of the benefits belonging to country life. Sometimes the little boy and girl trudge at the side of their mother —the one carrying a basket of chickens, ready for cooking; the other, some vegetables or fruit, the produce of their own bit of ground. And these people are happy, *because they are industrious, honest, and contented;* their wants are few—they earn their bread by the sweat of their brow, and they thank the Merciful Giver of all for the blessings He bestows upon them.

The various exhibitions of agricultural implements held throughout the country have, however, shown the people how labour can be saved and the work improved; and we have several modern churns, amongst which is the box-churn. In this a spindle, to which beaters are attached, is made to turn round, whilst the box is fixed; and there are others by far too numerous to mention here.

In making butter, the milk is first allowed to cool; the cream is then skimmed off and put into large pans for several days until enough is collected for a "churning." Of course, any difference in the mode of making butter will produce different kinds, and thus some persons like the butter made in one county, whilst others may prefer that made in another. In Devonshire the milk is not allowed to cool, but is at once carefully heated in deep pans. A scum rises, which is pushed aside, and whenever bubbles of steam appear the milk is removed and allowed to cool, when a good deal of the milk becomes nearly as thick as butter. This is skimmed off, and is the Devonshire clotted cream of which some people are so fond.

About three-quarters of all the foreign butter sold in Great Britain comes to us from Holland; but our own home-made butter, especially that from Cambridge and Epping, is the most highly-esteemed.

The churning must not be done too fast, for by that means the butter becomes soft and frothy, and is said to be "burst." When all the butter that is in the milk has gathered into lumps, these are well kneaded in spring-water on a board, so that all the buttermilk may be pressed out; it is then divided into the requisite sized pieces, and stamped with some pattern, as you have no doubt seen—a cow, a flower, or the like. In order that butter may keep some time, salt is mixed with some of it. This has to be well kneaded into it, so that it may be equally spread throughout the whole mass. The foreign butter comes into our markets in small barrels called firkins.

Cheese.—Cheese is the caseine contained in milk, separated from it by means of an acid obtained from rennet, which is the inner lining of the true stomach of the sucking calf,* and the acid it contains is neither more nor less than the gastric juice. The rennet is prepared by removing the stomach from the animal as soon as killed, and scraping off the outer skin and fatty matter. The lining membrane is then salted for some hours and stretched out to dry; it will then keep a long time. A small piece is cut off when required and soaked in a little whey or water, which is then added to the milk to be curdled.

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* See drawing of the stomach of ruminants, "Animal Kingdom," Cassell's Primary Series, p. 55.

In making cheese the milk is gently heated and placed in a large wooden tub, where the rennet is added, and the process which then goes on is called *earning.* In about half an hour the curd is formed, the liquid whey is then pressed out, and the curd chopped into small pieces with a knife called a curd-cutter, a little salt is added, and then the pieces of curd are put in a cloth in a cheese-vat, which is a wooden tub with holes pierced in the sides and bottom.

The whole is then put under a cheese-press, and by means of great pressure the remains of the whey are squeezed out and the curds pressed close together. After two or three hours, the cheese is turned and turned again, and in two or three days it is sufficiently solid to be removed to the shelves in the dry-room, where in about six months it is said to be "aged" or "seasoned" for the market; but all this varies in each cheese-making district; in fact, almost every farmer has a method of his own, and of course, like many of us, he thinks his own way better than that of anybody else.

The reddish colour of some cheese is given to it by Arnotto, or Anatto, which is obtained from a plant belonging to a family called *Bixa*, growing in the East and West Indies, and in South America. The seeds of the tree lie packed in a soft bed, made of a substance something like wax, and of a deep red colour. This is made into cakes or balls, from which the colouring matter is afterwards extracted, and it is generally sold in stone bottles as "liquid arnotto."

There are, as you know, many sorts of cheese, the differences between which is owing to the food given to the cows, the peculiar mode of working the milk, &c. Skimmed milk cheese is made from milk from which the cream has been removed and colouring matter added. Sweet milk cheese is made from the whole milk and therefore contains much of the butter along with the caseine. *Stilton* cheese is made in Leicestershire, by adding the *cream* of the *previous evening's* milking to the milk of the next morning—an extra quantity of butter is thus obtained in the cheese, and this is therefore one of the most valuable kinds. *Cheddar* cheese is made in Somersetshire from the whole milk, and the whey is several times skimmed off, heated, and added to the curd to scald it. Cheshire and Gloucester cheeses are made of the cream and curds of one milking. You must understand that cheese is valued according to the amount of butter it contains, and the fields of Cheshire afford such good pasture to the cattle that their milk yields great quantities of butter, and it is this which gives its value to Cheshire cheese. The Double Gloucester—like the Stilton—is made by adding the cream of one day to the milk of the next; and single Gloucester, from half new and half skimmed milk.

You will be amused when I tell you about the Suffolk cheeses; they are made from skimmed milk, and are called "Suffolk bangs" because they are so hard (for caseine without butter is very hard), that people say in joke, "The dogs bark at them, pigs grunt at them, but neither can bite them." These cheeses are, as you can well imagine, very indigestible; but still, you know, they contain the caseine, which is a flesh-former, and as they are sold at a very low price, they are much eaten by labourers whose digestion is strengthened by their work and fresh air. Cream cheese is prepared from cream curd, which has been placed in a cloth and allowed to drain without any pressure. We obtain our supply of this mainly from Bath and York. Parmesan cheese comes from Parma, in Italy, and owes its fine rich flavour to the superior herbage in the district where the cattle are fed. Swiss cheese is flavoured with herbs, and is very much liked, especially the kind called Gruyère.

You must understand, then, that although cheese contains a greater quantity of nutritive matter than cooked meat—in fact, when digested it contains a larger proportion of flesh-forming matter than any other article of food; still we could not live upon it. Some people have taken it for a time, but have been obliged to give it up, for, as I have told you already, the caseine when separated from the liquid in which it existed is so exceedingly indigestible.

Well, then, you will ask, if cheese is so very indigestible, why do people eat it after a good meal? They cannot be hungry, for if they had not had sufficient, why not take more of the food which they know to be digestible, instead of "finishing off" with cheese, of which they know quite the contrary?

Well, if they were really to eat a *quantity* of cheese it would produce indigestion most certainly, but a very small piece does service in a way of which I will tell you.

You must know, then, that caseine is easily *decomposed*—that is, a state of change soon begins in it, and this change spreads to other substances with which it is in contact. Thus, when it enters our stomach, it starts the change in the food already there, which is necessary; for unless the food be changed it would not be converted into chyle; and although this change would set in of itself after a while, a morsel of cheese, in which the change sets in more quickly, hastens the process, and so assists in digestion, and this is the reason, too, why some persons prefer mouldy cheese, because in that the change has already begun.

Now do not run away with the idea that cheese is a very bad thing to eat, because that would be putting a wrong meaning on what I have told you, and would deprive you of your "bread and cheese," from which you know you derive so much nourishment. I only point out to you that the caseine is indigestible if you take it alone, or if you take too much of it; but bread and cheese, with *much more* bread than cheese, and a glass of milk, is a meal which, if taken whilst you are active, is nourishing and pleasant, and we can only wish that thousands of our starving fellow-creatures could obtain such. I have spoken of the *abuse* of an excellent article of food so that you may value its *use.*

Eggs.—The eggs chiefly used for food are those of the species commonly known as poultry. Of those called "Gallinaceous" or Rasores,* the common fowl, the turkey, the peahen, and the guinea fowl produce eggs most generally used. Of web-footed birds, the duck is in this respect the most important; but the eggs of other web-footed and marine birds are sought after by the inhabitants of the wild and rocky regions which they frequent. The inhabitants of St. Kilda, a small island lying off the west coast of Scotland, and the people of the Orkney and Shetland Islands, use them as one of the most important articles of their food, and in quest of eggs and young birds incur dangers which quite terrify us to think of. These men, who are called *eggers*, are let down by ropes to gather the eggs from the nests on the ledges of the rocks, and so, you see, they obtain food and maintenance for their families at the risk of their lives.

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* See "Animal Kingdom," page 101.

A good-sized hen's egg weighs 1,000 grains, of which the white is 600 grains, the yolk 300 grains, and the shell 100. The white is pure albumen dissolved in water, and thus mixes easily with water when raw, but hardens when heated. The yolk also consists of albumen and water, but in addition contains multitudes of little bags of oil, so that in eating an egg we are really eating both a heat-giver and a flesh-former. Taking 1 lb. of eggs, both white and yolk mixed, we should have 12 ozs. water, 2 ozs. albumen, and 1½ ozs. oil or fat. The rest of the weight being made up by saline (or salty) matters. Eggs are very nutritious articles of food. They contain as much oil or fat and flesh-forming matter as butchers' meat, but the white is not so digestible. English poultry does not by any means supply eggs in the quantity we require, and therefore we have to import them from abroad. There are no means of finding out the exact quantity of eggs produced in England during the year, but from various sources we obtain the information as to foreign eggs. The following account of the egg trade is taken from the *Food Journal*:—

"It appears that the importation and use of eggs in England increase vastly from year to year. From 1843 to 1847 the import for each year amounted to 73,000,000 of eggs; during the next years to 103,000,000, soon rising to 163,000,000. In the year 1861 there were 203,000,000, in 1864 335,000,000, and in 1866 as many as 430,878,880 eggs; the value being £1,097,197. By far the greatest part of our imports came from France. On the other hand, very few eggs are brought from Germany. The cargoes of eggs are chiefly shipped in steamers, and sent to the harbours of Southampton, London, Folkestone, Newhaven, and Shoreham. The time of egg-laying begins in France from January to March; April, May, and June are the most productive months. In July the production falls off, takes up a little again in August and September, leaves off entirely in October and November, and in December is absolutely nil. (that is, it ceases altogether). In order to obtain eggs, even at this time, scientific means are employed. The stables are warmed, and the hens are fed with buckwheat and meat. Paris alone consumes 12,000 francs worth of eggs. One may generally assume that the districts which grow buckwheat produce most eggs. The harbours from which the greatest exports of eggs take place are Calais, Cherbourg, and Honfleur. At Calais, the eggs are packed in chests and straw, 1,100 eggs in each chest; at Cherbourg and Honfleur in chests of 600 to 1,200. The business is very profitable, and such results might probably follow in Germany if the landowners, especially the smaller proprietors, would introduce a rational system of poultry-keeping. Of late years masses of eggs are opened in German markets, and the yolk sold cheap; the white being purchased by manufacturers."

The lightest way of dressing eggs is by poaching them. This is done by breaking the shell, and dropping the whole egg into water which is boiling briskly; in a minute or two the white sets, and the membrane containing the yolk just stiffens without hardening the inner part too much; they may then be lifted out for serving. To boil eggs, they should be carefully lowered either by a spoon or egg-boiler into boiling water, and allowed to boil for three minutes; less than this will not allow the white to solidify, and longer will make the yolk hard and indigestible.

CHAPTER IX.

Of Animal Food.

In the previous pages I have spoken of food which we obtain *from* animals, and I now proceed to tell you about the nutriment we receive from the bodies of the animals themselves, and we will begin with

Beef.—If a piece of fresh beef be dried in the hot sunshine, or in a basin over heat, it will shrink, dry up, decrease in size, and lose so much, that *four* pounds of fresh, newly-cut beef, will leave only *one* pound of dried flesh. If we take a piece of lean beef and wash it over and over again in water, its colour will gradually disappear. The blood it contains will be gradually washed out, and a white mass of fibrous tissue will remain; by chemical means the fatty matter may be dissolved, and then nothing will remain but a mass of fine hollow threads or fibres, to which the name of *fibrine* is given.

The lean part of the muscles of animals, which we call *flesh*, is made up principally of this fibrine, and it is to build up this that it is necessary that we should take food which contains the necessary ingredients.

Let us see how beef differs from bread. I have told you that we can separate beef into three substances—water, fibrine, and fat.

Now bread contains water, fibrine, fat, and *starch*, of which there is not a particle in beef, whilst it constitutes almost half of the weight in wheaten bread; and further, the fibrine in beef is about three times that contained in bread; or a pound of beefsteak is as nutritive, as far as this *one* ingredient is concerned, as three pounds of ordinary wheaten bread.

In the dry matter of flesh, too, the proportion of fibrine is greater than the gluten in any known vegetable food, much greater, in fact, than in dried bread made from any of our cultivated grain. Thus (Johnstone's "Chemistry of Common Life") if we compare perfectly dry flesh with perfectly dry oatcake—oatmeal being the richest of our common kinds of meal—we shall find the difference presented to us in a striking light. Let us, then, imagine any quantity of dried flesh, and the same of oat-cake, divided into 100 parts, then the following table will make the proportion very plain to you:—

	Fibrine or gluten.	Fat.	Starch.	Blood & salts.	Total
Dried Flesh contains	84	7	0	9	100
Dried Oat-cake ,,	21	7	70	2	100

You will thus see that the animal food contains four times as much gluten or fibrine as the oatmeal, but is wholly deficient in the other ingredient, of which so large a proportion is contained in vegetables—viz., starch, which you will see in oatmeal forms seven-tenths of the whole weight.

The flesh of wild animals is much about the same as that I have given, for you can well understand that such animals run about too much to gather much fat. But the animals which are reared on purpose for food generally contain large quantities of fat, either collected by the animals in various parts of the body (the suet or tallow), or mingled with the muscles, as in the much-prized *marbled* beef, in which the English delight. In the boiling-houses of Port Philip, a small merino sheep of 55 pounds weight gives 20 lbs. of tallow, or nearly two-fifths of the whole.

In beef and mutton, such as is met with in our markets, from a third to a fourth of the whole weight generally consists of fat.

Now let us compare the amount of

THE VARIOUS MATTERS CONTAINED IN ONE POUND OF BEEF, MUTTON, PORK, LAMB, AND FOWL.

	Water.		Gelatine.		Fibrine & albumen.		Fat.		Mineral matter.	
	ozs.	grs.	ozs.	grs.	ozs.	grs.	ozs.	grs.	ozs.	grs.
Beef	8	0	1	62	1	122	4	340	0	350
Mutton	7	16	1	52	0	385	6	176	0	245
Pork	6	69	0	385	0	315	8	0	0	105
Veal	10	0	1	82	1	199	2	281	0	312
Lamb	8	44	0	400	0	360	5	263	0	244
Fowl	12	107	1	52	2	104	none		0	174

Now let us leave these figures and see how to make the best use of them. And as I have told you, in cooking the meat, it is either possible to prepare it so that all the nutriment may be obtained from it, or that it may be wasted altogether.

Let me first tell you about beef-tea, which is, you know, a liquid form of food which is given to invalids and persons who cannot digest anything solid. I have already told you that the digestive powers of the stomach act better on solids than on liquids; but when those powers are weak, and liquid food is necessary, of course it is well to know how the greatest amount of nutriment can be obtained from the meat.

Now it is not necessary to boil the beef in order to extract the nutritious matter from it; for you will remember that the albumen hardens by heat, and would therefore remain in the meat instead of passing into the beef-tea. The best plan, therefore, is to cut the meat into small pieces, and to pour upon it a little soft water, and a few drops of hydrochloric acid with a little salt. After this has stood a few hours, the liquid should be strained off, and when heated is ready for use, as much water as may be required being added to it. This liquid contains not only fibrine and albumen, but other compounds found in the juice of flesh. Dr. Lankester says, "Amongst other things it contains two substances found in the flesh of animals, called creatine and creatinine. They resemble in their chemical nature quinine, and they are found in human flesh. It may be that it is those substances which give so much value to animal food. It may be that to have these things ready made in our food may facilitate the nutrition of the muscles, and other vital parts of our bodies. Beef-tea made in this way contains also the mineral compounds of potash and phosphoric acid.

"We learn a lesson from this method of making beef-tea in the preparation of our animal food. It so happens that the creatine, and the creatinine, and the salts of which I have spoken, can all be boiled out of meat, and when the meat is served at table, and the water is thrown away, you have really got rid of some of the most important constituents of your food. If the meat is put into the water before it boils, and the albumen has time to exude, the saline matters, with the creatine and the creatinine, will also escape; and in this way you get rid of the most important matters of the food.

"On the Continent they are more alive to the economy of cooking, and in consequence they use the water in which the meat is boiled for the purpose of making soup. Not only does this apply to meat, but also to fish. The liquid in which fish is boiled is just as valuable as that in which any other articles of diet are boiled."

The ordinary modes of cooking animal food are boiling, roasting, broiling, baking, and frying. Of these, boiling, roasting, and baking are the most general; we will therefore see which of these is the most economical.

During cooking

	In boiling.		In baking.		In roasting.	
	lb.	oz.	lb.	oz.	lb.	oz.
4 lbs. of beef lose . .	1	0	1	3	1	5
4 lbs. of mutton lose .	0	14	1	4	1	6

The greater loss in baking and roasting arises chiefly from the greater quantity of water which passes away, and of the fat which is melted out during the two methods of cooking.

Now the presence of albumen in meat, is of much importance to us in the skilful preparation of food. The first effect of the application of a quick heat to a piece of fresh meat is to cause the fibres to contract, to squeeze out a little of the juice, and, to a certain extent, to close up the pores, so as to prevent the escape of the remainder. The second is to coagulate or harden the albumen contained in the juice, and thus completely plug up the pores, and retain in the meat the whole of the internal juice. After this, the cooking goes on through the natural moisture of the flesh. Converted into vapour by heat, a kind of steaming takes place within the meat, so that whether in the oven, on the spit, or in the midst of boiling water, it is in reality, when skilfully done, cooked by its own steam.*

If we wish the boiled meat to contain the largest amount of nutriment, but do not intend to use the liquor or broth in which it is boiled, it must be put into the water whilst it is boiling briskly. The boiling must be kept up for a few minutes, by which means the albumen near the surface is hardened, so as to form a crust, which prevents the entrance of water into the interior, and the escape of the juices and nutritious portions of the meat. Cold water may then, from time to time, be added, so as to keep the water just at the proper heat for the time necessary to cook the meat, namely, about twenty minutes for each pound weight. This is according to the advice of the great German chemist, Liebig, in his "Researches on the Chemistry of Food," and he says, "All the conditions are thus united which give to the flesh the quality best adapted to its use as food."

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* "Chemistry of Common Life."

If, on the other hand, we wish to obtain soup from meat, we should place it in *cold* water, and let this gradually reach the boiling point. The interchange between the juices of the flesh and the water by which it is surrounded, which was prevented by the former process, now takes place without hindrance. The water penetrates into the meat, and dissolves some portions of the nourishing matters, which are then drawn out, and thus, whilst the flesh loses, the water gains. The meat, of course, becomes tough, and if eaten without the soup, loses much of its nutritive properties and of its digestibility.

In both roasting and broiling, which are very nearly alike, the heat should be strong, and rapidly applied, so as at once to congeal the albumen, and thus form a kind of crust which keeps in the juices; then, although the weight of the meat is diminished, it is principally in consequence of the water which has evaporated, the juices being all retained, and nothing being removed but some of the fat and gravy, which are in themselves articles of food.

I am sure all of you like roast beef, and you would not be very pleased, if when you came home, you were told that you *were to have had* a nice roast joint for your dinner, but no one knew how to cook it properly, and thus it was spoiled. You must therefore be patient, whilst I tell your sisters how to cook this regular old English meal, and the little girls must attend.

For roasting, the sirloin and ribs of beef are considered the prime joints. Before the meat is put upon the spit, it must be washed, and then dried with a clean cloth. Cover the fat with a piece of white paper fastened on with string; make up a strong, good fire with plenty of coals, put on at the back. When the joint is first put down, it should be about ten inches from the fire, and then gradually drawn nearer. Baste it all the time it is roasting; at first with a little fresh dripping; afterwards its own fat will be sufficient. About ten minutes before it is to be taken up sprinkle over it a little salt, dredge it with flour, and baste it again. The time it will take in roasting depends upon the thickness of the piece. Thus a sirloin weighing about 15 lbs., should be roasted for about three hours and a half, while, of course, a thinner or smaller piece will be cooked in less time. Meat takes longer to roast when newly killed than when it has been kept, and longer in cold weather than in warm.*

Baking is, as you know, the mode of cooking in a closed chamber called an oven. Ovens generally are pretty nearly air-tight, and thus the steam arising from the dishes being baked, is confined, and this gives them a strong and sometimes a rank taste. Some ovens have ventilators admitting a current of air, by which this is greatly avoided. Baking, although a very convenient mode of cooking, is less wholesome than roasting.

Frying is the most unwholesome way of cooking meat, because it is as it were boiled in hot fat or oil, and this soaks into it until it is nearly dried up. Still this effect may be greatly diminished by using very little grease, and in some cases, as in that of fish, allowing as much of it as possible to drain off after frying.

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* From *Cassell's Household Guide.*

Having thus told you the amount of nutriment contained in some of the animals used as food, and how to cook their flesh so as to obtain from it as much benefit as possible, I will give you a brief account of the animals themselves, and a few hints as to rearing them for food.

You have, no doubt, read in another book* about oxen—how they chew their food again and again, and how very useful they are to man; and you will thus be prepared to learn more about them.

The varieties or breeds differ very much in size. Some, which are natives of Shetland, are not much larger than the calves of other breeds; and perhaps you have seen the pretty little Indian ox, with its soft, smooth skin, and its little hump on its back.

The short-horned breed, of which an engraving is given on the next page, is one of the most valuable of oxen. It was first bred on the banks of the Tees, and has spread very widely both in England and Scotland. The colour varies from pure white to bright red. The beef of the shorthorn is considered excellent, but the Ayrshire breed is preferred for dairy purposes, whilst the Alderney cow is noted for the richness of its milk.

The rearing and fattening of the ox is one of the most important branches of agriculture, and owing to the high prices of butchers' meat has received great attention in recent years. Fifty years ago, many of our old breeds of cattle were kept four and five years before they were sent fat to the butcher.

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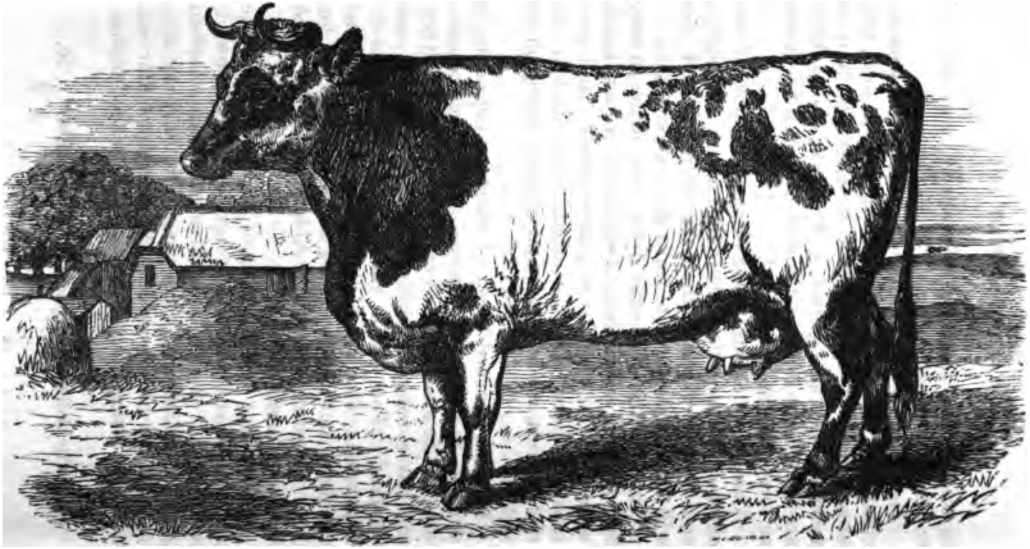
* "The Animal Kingdom," "Ruminants," p. 50.



SHORTHORN COW.

The demand for meat was so limited then in the North, that most of the cattle were sent lean to the South, to be fattened on the pastures and turnips of the eastern counties of England. The introduction of steam shipping, and of railways, has given the Scotch farmers greater opportunities for selling their fatted stock, and now there are no lean cattle sent to the South.

The varieties of sheep from which **Mutton** is obtained are very numerous. The sheep was the first animal reared by man, for you will remember that in Genesis we find: "Abel was a keeper of sheep;" and from that time forward we find sheep and lambs constantly mentioned in the Bible.

The ancient Britons possessed sheep before the Roman invasion, and afterwards Britain became famous for its wool and woollen goods, which were much valued by the Romans. The great object of sheep-farming at that period was the production of wool, but the demand for butchers' meat has now so increased, that the farmer finds it profitable to devote his attention to supplying the market with these articles, and those sheep are considered most valuable which are most suitable for this purpose, even though their wool is not as good as that which we import from other parts of the world; but the *quantity* of our wool in some degree makes up for its want of fineness.

When there was no food for sheep but the natural pasture, they could only be fattened for food during the summer, and not until they were four or five years old; whereas now, much of the mutton which is eaten is the flesh of sheep only two years old, the sheep being fattened by the aid of oil-cake, mangold-wurtzel, turnips, &c.

Mutton is one of the most generally used meats in families, being very wholesome and digestible. The mutton furnished by the Leicestershire, Southdown, and Cheviot sheep is considered the best. The name Southdown is derived from the chalky *downs* of the *south* of England, but it is now bred throughout England and the south of Scotland. The London and other markets are chiefly supplied with sheep called half-breeds, which are of a larger size than the true southdowns. The legs of mutton of these breeds range from seven to eleven pounds weight; the shoulders, neck, or loins, about six to nine pounds.

Pork.—The flesh of swine forms a great portion of the food of many nations, not because it is very nutritive, as you will see by comparing it with the other sorts of meat given in the list in page 61, but because it is more easily salted or preserved than any other flesh; and as it contains a great quantity of fat, it makes a heat-giving food in cold or temperate climates. A great deal of pork is cured in Great Britain, but the quantity imported from America is immense. In 1862 nearly half a million of barrels of pickled pork, and hams and bacon to the amount of £2,477,005, were received from the United States. The following account, from an American newspaper, will give you a good idea of the trade carried on:—"There were between five and six acres of barrelled pork piled up three tiers high, in open lots, and not less than six acres unpiled, which would cover eighteen acres if closely laid in a single tier on the ground; besides all which, six acres of pens were filled with hogs *waiting to be killed.*" Next to America, Ireland, especially the neighbourhood of Cork, furnishes the largest supply of cured pork, and London, Wiltshire, and other parts of England, also furnish vast quantities of bacon and ham for general use. The law of Moses forbids Jews to eat pork—the swine being one of the animals classed as unclean; and this law has also been adopted by the Mahometans. The flesh is considered indigestible, and the swine is particularly liable to a disease caused by a very small worm, called the *Trichina*, which, on being eaten in pork, causes the same disease and death to human beings. Persons who eat it should, therefore, be very careful that it is in a healthy condition. A young woman died, after much suffering, in the Dresden Hospital, in 1860. After death, numerous Trichinæ were found in her muscles. It was then discovered that three weeks before, she had assisted in killing pigs and making sausages, and had eaten some. On examination it was discovered that both the pork and the sausages contained the worms; and the butcher, and several of the girl's family who had partaken of the sausages, were attacked with symptoms similar to those which in the case of the young woman had caused death. According to the best accounts, out of 25,000 pigs, the carcases of which were examined in Hanover, 11 were found to contain the trichina; in Brunswick, 16 were affected out of 14,000; and in Blakenburg, 4 were diseased out of 700.

The French Commissioners state that the worm is killed by heat, and that meat thoroughly salted i ssafe. These scientific men give it as their opinion that the spread of the trichina amongst pigs is caused by their being "foul feeders," which eat any offal—such as the dead bodies of rats and other animals, which are known to be liable to the disease, and they therefore recommend farmers to be very cautious in feeding their pigs, to avoid giving them flesh without first boiling it, and to remove all filth and decomposing matter out of their reach. Although the trichina was first seen in England, and has been noticed in Scotland and Ireland, there have not been, as far as known, any real cases of disease caused by its spreading amongst the pigs. This is most likely in consequence of the greater care and cleanliness in rearing pigs in this country.

CHAPTER X.

Of Poultry and Fish.

The term "poultry" is derived from the French word *poule* (a hen); and it is generally taken to include the members of the two groups—the Rasores, or scratchers; and the Natatores, or swimming birds.* To the first belong the Common Fowl, the Pea-fowl, the Guinea Fowl, the Turkey, and Pigeon; and to the latter belong the different kinds of ducks, geese, and the swan.

The common fowl has been reared in England from the earliest ages, and has always been highly valued, affording as it does wholesome and delicious food, not only in its flesh, but in its eggs.

There are a great many breeds of fowls, but those most valued are the Poland, or Black, the Dorking, the Bantam, the Game fowl, and the Malay. The Common, or Barndoor fowl, is one of the most delicate sorts, and the best kind are bred

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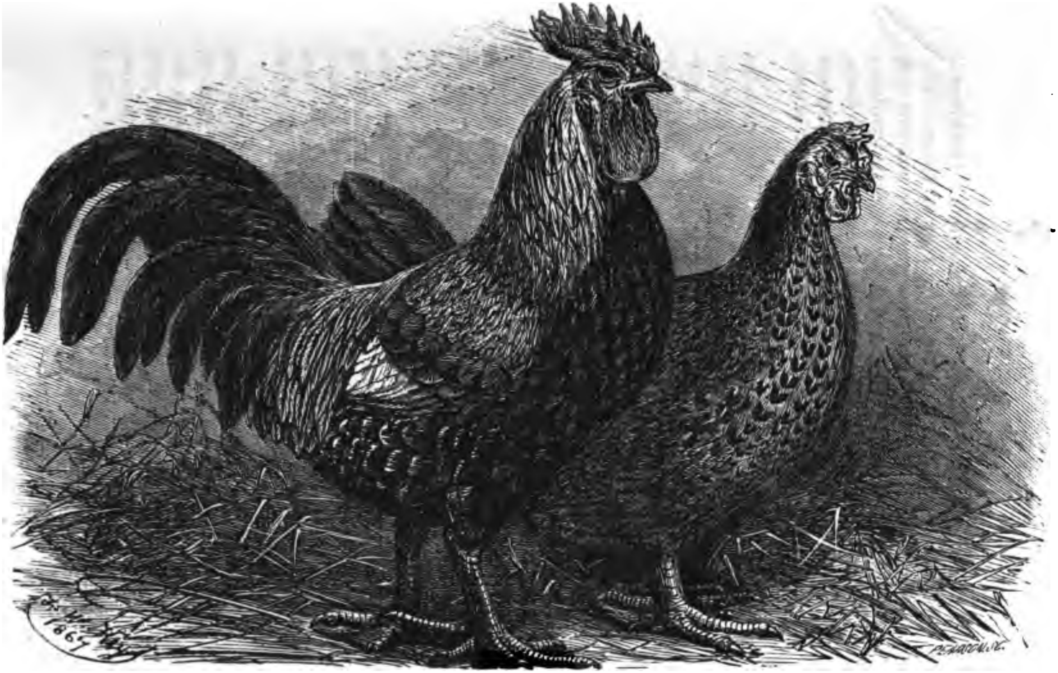
* See "Animal Kingdom," pages 101 and 106.



DORKINGS.

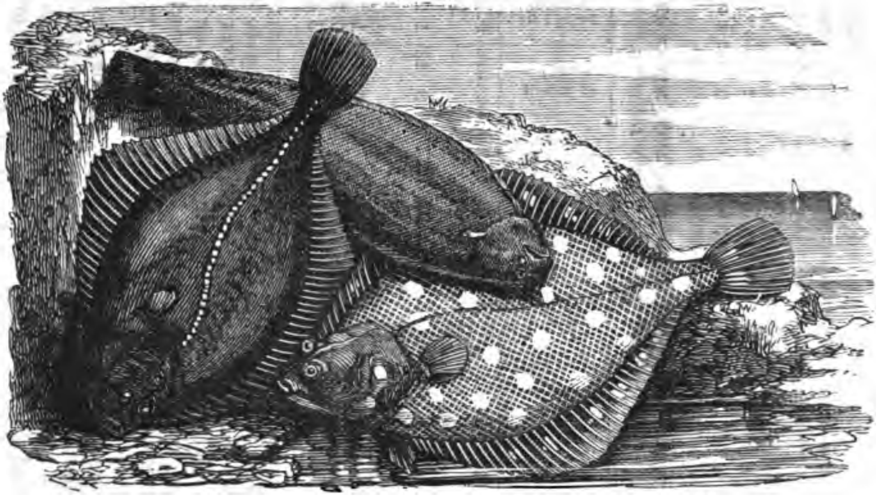
at Dorking, in Surrey, and are called "Dorkings." I have given you a picture of a pair of these. The young female fowls, until they are four months old, are called chickens, after that they are called pullets; and when they begin to lay they are called hens. The English counties which produce the greatest quantity of poultry, are Surrey, Sussex, Norfolk, Herts, Devon, and Somerset.

It has been generally agreed that the flesh of chickens is one of the most delicate and easy to digest of all animal food, and it is very fit for persons who are ailing, or whose stomachs are naturally weak. They should be chosen young, as they grow tough with age, and are then only fit for boiling into soup, not for roasting or cooking in any other way.

Fish as an Article of Food.

Although the flesh of fish is not as nourishing as that of quadrupeds or birds, it is still valuable as an agreeable and wholesome article of food, and is largely eaten by all classes of society. It should form a portion of every well-regulated dietary, but, of course, would not be a sufficiently strengthening food if taken constantly, at least in this climate; but there are countries where the only animal food taken is fish, and fish-oils are very rich in what are called "force-producers."

The principal fisheries of Great Britain are those connected with the capture of salmon, herring, shellfish, cod, soles, turbot, mackerel, &c. Immense quantities, as I shall presently show you, are consumed in this country—in fact, the figures I shall give you in relation to London alone will, I know, surprise you.



THE FLOUNDER, SOLE, AND PLAICE.

The numerous railways which bring the fish from the coast have done good service to the country, for much good fish was formerly wasted because it could not be conveyed with sufficient rapidity to places where it could be sold.

I must now ask you to look at the following table, which is taken from that given in the Food Collection in the South Kensington Museum.

ANALYSIS OF ONE POUND OF SALMON, MACKEREL, SOLE, CONGER EEL, PIKE, AND HERRING.

	In 1 lb. of Salmon.		In 1 lb. of Mackerel.		In 1 lb. of Sole.		In 1 lb. of Conger Eel.		In 1 lb. of Pike.		In 1 lb. of Herring.	
	ozs.	grs.	ozs.	grs.	ozs.	grs.	ozs.	grs.	ozs.	grs.	ozs.	grs.
Flesh, including Fibrine, Albumen, and Gelatine	2	43	3	387	1	350	3	233	3	23	1	270
Fat . . .	0	301	1	56	0	14	0	350	0	42	1	60
Salts . . .	0	387	0	57	0	36	0	84	0	91	0	145
Water . .	12	143	10	374	13	374	11	208	12	281	12	400

The **Salmon** is a very fine fish and belongs to the group called *soft finned.* In spring it leaves the sea and ascends the rivers in great shoals, swimming with great rapidity and leaping over obstacles ten or twelve feet high. Salmon deposit their eggs in the gravel and then return to the sea. The young ones, when they are about ten or twelve inches long, proceed to the sea as their parents had done before them. Salmon are caught when they ascend the rivers, for after the spawning is over they are meagre and unwholesome for food.

About ***half a million*** of salmon are consumed in London in a year; the weight of which is about 1,555 tons, and the value of which is about £124,000.

The **Mackerel** belongs to the *spiny-finned* fishes. It is caught in great numbers. It moves about from one part to another, and at certain seasons it abounds on the coasts of Europe and America. Mackerel visit the shores of Great Britain in great shoals, appearing about March, off the Land's End, in the bays of Devonshire about April, off Brighton in the beginning of May, and on the coast of Suffolk about the beginning of June, whilst in the Orkneys they are seen until August. Owing to the rapid transit by means of railways, the mackerel can be obtained in London during all these months.

Mackerel weigh from one to two pounds, and are generally from twelve to eighteen inches long.

The number of mackerel consumed in London in a year is about *twenty-four millions*, weighing 10,500 tons, and selling for £130,000.

Soles are much esteemed for their delicate flavour, and are consumed in great quantities. They are abundant in the British waters, but those taken on the western coast are larger than those on the northern. The Torbay are generally considered the best. About ninety-eight millions of soles are annually consumed in London, weighing about 12,000 tons, their value being about £20,000.

Herrings are perhaps the most important to mankind of any kinds of fish, and the most abundant too, the roe of the female herring containing about 68,000 eggs. Great quantities are caught in Holland, but the Scotch herring fisheries are the greatest in the world. No account is kept of the number of herrings yielded by the waters surrounding England, but you can form some notion of the quantity when you are told that the people of London consume about 131,250 tons of herrings per year, the value of which is about £1,675,300; whilst the little sprat is sold to the extent of 1,780 tons, for about £12,000. The **Cod** rivals, if indeed it does not surpass, the herring in its importance to mankind, and is in great request for the table; the weight is from 10 to 50 lbs., or even more; and the roe of the female has been estimated to contain from four to nine millions of eggs. The Cod is found in all the northern parts of the Atlantic Ocean, and in the Arctic Seas, but is not known in the Mediterranean.

Cod sounds are esteemed a delicacy, and are often salted and sent to market. The cod is used as food either fresh, salted, or dried. Great quantities of dried cod are carried from Newfoundland to the West Indies. The recent discovery of the use of cod-liver oil in medicine has greatly added to the value of this fish. About half a million of cods are sold in London in a year.

Besides the fish I have thus briefly mentioned, we use as food, Turbot, Carp, John-dory, Eels, Plaice, Gurnet, Haddock, Whiting, Red and Grey Mullets, Brill, Pike, Skate, Smelt, Trout, Whitebait, and others by far too numerous to mention, together with vast quantities of lobsters, crabs, oysters, mussels, cockles, shrimps, &c.

And now I must give a few hints on the manner of using fish as food.

Fish when they have done spawning are out of season; they are then thin and unhealthy, and therefore should not be used for food.

When fish is out of season, it has a bluish transparent appearance, and is soft, however much it may be boiled; but when in season the flesh is firm, white, and curdy.

For delicate persons soles, whiting, and haddock, and others the flesh of which is white, are the best. Salmon is extremely unfit for invalids.

Salmon, mackerel, and herrings soon spoil, and these should therefore be cooked as soon after they are obtained as possible.

Great care should be used in dressing fish for the table; they should be scraped and washed, but should not be too long soaked in water, as by that means much of the flavour is removed. A little vinegar and salt should be put into the water in which fish is to be boiled, to give it firmness.

Any boiled fish that may be left from a meal may be put in a dish and covered with vinegar and spice, and thus pickled will keep for several days.

Fish should be put into *cold* water and allowed to boil very gently, so that the outside may not be done long before the inside, in which case it will crack and present an untidy and ugly appearance when served; besides which the water will soak into the fish and make it flabby.

Fish for frying, should be well dried, and then be either dipped in a thin batter, or brushed over with egg and rubbed with bread-crumbs. Some people fry fish in butter, and some in lard; but olive oil is by far the best.

The great wholesale market for fish in London is Billingsgate, which early in the morning presents a sight quite beyond description.

This wharf was opened in 1558 as a landing-place for provisions, and in 1699 was made a free and open market for all sorts of fish, every kind of which, whether fresh or cured, is admitted free of duty, if taken by British subjects and imported in British ships. Lobsters and Turbot are admitted free even though in foreign vessels. All fish are sold by *tale*, that is, by number (from the Saxon word *talan*, to count), except Salmon and Eels, which are sold by weight, and Oysters and other small shell-fish, which are sold by measure.

Until the beginning of 1870 Billingsgate was the only wholesale fish-market in London; but for the greater convenience of the trade and the public, a new market in the neighbourhood of Shoreditch was opened. The Columbia Market, which had been built for the general sale of provisions, &c., by the munificence of Miss Burdett Coutts, was at the period named converted into a second wholesale fish-market, and seems likely to become a great boon to all engaged in the trade.

"And now," says Dr. Letheby, "before leaving this part of the subject, let us pause to consider the vast machinery which is in operation for the supply of food to this metropolis.

"At the present time over three millions of people have to be fed daily, and yet so regular is this supply, that no one considers even the possibility of its failure. On the other hand, there is no redundancy:* not only does this supply regularly reach the metropolis, but it is distributed to our very doors. About 4,200 tons of fish, over 400 sheep, nearly 700 oxen, about 90 calves, 4,000 pigs, including bacon and hams; not less than 5,000 fowls and other kinds of poultry, besides a million or so of oysters and eggs innumerable, with flour enough to make a million quartern loaves, and vegetables, butter, and beer in proportion, are daily brought to our city."

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* *Redundant.* More than wanted.

CHAPTER XI.

Of Heat-giving Food.

MUCH of the food which we take does not go towards increasing the size of our bodies, but to keep up a certain amount of heat which is necessary to us.

This heat is the same in man wherever he may be; whether in the Torrid or the Arctic regions, his blood will always be equally hot.

Heat is measured by means of a little instrument called the **Thermometer**, and by that in general use (Fahrenheit's), the heat of our blood is 98 degrees; whilst water freezes at 32 degrees.

Now it will be clear to you that if a man be placed in an atmosphere where all around is freezing, he must obtain the heat for his blood from fuel which he deposits *within* his body, since all around is cheerless and frigid.

But too much heat would be gathered within us were it not that it is constantly regulated by our skin, which is so spread over our bodies as to form what is called an "evaporating surface," and thus all the heat which we do not require is thrown off as perspiration.

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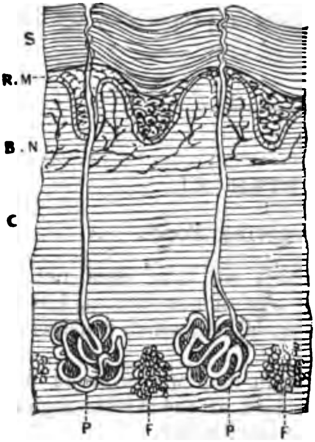
You may read more about the blood, how it passes into the lungs, and heart, and how it travels over the body, in another little book belonging to this set, and I advise you to refer to it.*



SECTION OF THE HUMAN SKIN.

S. Scarf Skin. C. Cutis. P. Perspiratory Glands and Ducts. F. Fat Granules. R. M. Rete Mucosum. B.N. Blood-vessels, Nerves and Papillæ.

The substances in food which are called *heat-givers* are divided into three classes, namely, **Starch, Sugar,** and **Fat.**

I have told you how to separate the Starch from the gluten in wheat; now, if I scrape a potato into water, some portion of it will sink to the bottom, and the rest will remain *mixed up* in the water, but not *dissolved* in it. The little atoms are then said to be "suspended;" that is, *hung up* in it. If I now pour off this water, the little grains will sink to the bottom of my glass, and this powder is potato-starch.

Now these granules do not lie loosely about; they are carefully put away in little bags called *cells.* The walls of these cells are, as you can well imagine, very thin; but they are made of the same material as our doors and windowframes. This substance is called **Cellulose** or **lignine.** It is this which forms the hard portion of wood, and we find it in all kinds of vegetable food. When the soft part of a turnip has decayed, you say the turnip is "woody," because scarcely anything but the woody fibre remains, and for the same reason celery becomes "stringy." There is about an eighth of an ounce of this woody fibre in a pound of potatoes. It is not digestible, but still it is found useful to help the other food.

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* "Our Bodies," Cassell's Primary Series.

Thus, then, not only mechanical force, but heat-force, takes place by the chemical change which food undergoes in the body. This change sets free certain powers which are contained in the food, which either give force to our muscles or heat to our blood.

Albumen, fibrine, and caseine, are called flesh and force formers, because they give both mechanical and heat force; whilst such substances as starch, sugar, and fat do not assist in forming flesh, but produce heat-force only.

I will tell you what Dr. Lankester said in one of his excellent lectures on this subject. "Starch is composed of carbon (or charcoal) and water. Carbon is found in all vegetable and animal matters, and when the carbon is left after burning, we call it charcoal. Now, if we calculate the quantity of carbon and the quantity of water contained in starch, we shall find that every 162 lbs. of starch contain 72 lbs. of charcoal. Here, then, is the source of its heating power. When we eat starch in sago-pudding, arrowroot, or in whatever form we are taking it, we take just so much fuel, and just as we heap charcoal on a fire, so we add starch to our body to keep up our animal fire, and carbonic acid gas* is the result." However, you must not imagine that we could live on charcoal, or that charcoal is good for dinner or breakfast. The fact is, carbon in its pure form cannot be digested, and before you can consume it, you must digest it. Hence the necessity of finding something which will enable you to transfer the charcoal into the blood and tissues of your body.

Even starch itself is not digestible; that is, it is not soluble in water; therefore it can never *as starch* get into the blood. There is never any in the blood. **The fact is, that starch, before it is used in the system, is turned into sugar,** and unless the starch of our bread and our puddings is changed into sugar, it is not converted into blood at all.

Sugar can be artificially produced from starch. Wherever we have starch in the vegetable kingdom, we have sugar. There is sugar in potatoes. It is also contained in rice. In sweet potatoes and carrots there are large quantities of sugar; also in turnips. Now man is provided in his mouth with substances for converting starch into sugar. Underneath the lower jaw are glands† which produce saliva, which has the power of converting starch into sugar. The moment you take the starch into your mouth, and the saliva mixes with it, it is converted into this soluble sugar, and thus the starch finds its way into the system.

There is one more property of starch that needs to be noted, and that is the power which it possesses of combining with water at a high temperature (that is, when very hot), and forming a thick, gelatinous mass. This appears to be caused by the bursting of the little starch-bags, and the chemical union of the starch with the water. It is in this way that the soft and liquid mixtures of starch become converted by boiling or baking into consistent pudding. There would be no pudding-making were it not for this property in starch.

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* Of which you have been told in "Our Bodies," p. 69.

† Called salivary glands. See "Our Bodies," page 48.

But let us see what purpose starch answers in the plant; for you must know that *all* plants possess *some* starch. Well, it is the food, or nutritive matter, which is laid up in the plant to nourish it in the winter. Now, light has the effect of turning the starch into *chlorophyle*, which is the green colouring matter of plants; the store is, therefore, usually collected in the roots, where, buried under the surface of the ground, it is removed from the influence of the sun's rays; then, when the warmth of the spring acts upon the grains of starch, they become gradually changed into sugar. They are then, as you know, readily dissolved in water, and the nourishment is thus conveyed to the tiny tubes which run through the stem and branches of the plant.

Rice.—This important grain, although one of the grasses, contains so large a proportion of heat-giving and fat-forming substances that it must be classed here, instead of with flesh-forming plants.

The Common Rice, of the cultivation of which I have given you an account in "The Uses of Plants," is one of the most useful and extensively-grown of all grain, supplying the principal food of nearly one-third of the human race.

The cultivation of rice is principally carried on in India, China, Cochin-China, Japan, Egypt, South

Carolina, Georgia, and other Southern States of North America. The quantity raised in India, whence we chiefly obtain our supplies, is estimated at three-and-a-half millions of quarters, the value of which is about £2,670,000.

The best quality of rice brought into the market is the Carolina, which was only introduced into that country in the early part of the eighteenth century.

Rice in the husk is known by the name of "Paddy."

As a food, rice is very healthy for children, as it counteracts internal disorders liable to be brought about by eating too much fruit, &c., independently of which it contains much nourishment.

Rice starch is made in considerable quantities in England, and is used in many laundries and muslin manufactories. Rice is much eaten in this country as an addition to other kinds of food. The small quantity of gluten it contains prevents its being used in making bread; but it is eaten with meat, gravy, or in the form of puddings or curry, and when mixed with milk it is a well-known and favourite dish for children.

The following is a table of the ingredients contained in 1 lb of rice, as exhibited in the Food Collection at South Kensington. The case shows:—

ONE POUND OF RICE WITH ITS HUSK.—ONE POUND OF RICE DEPRIVED OF ITS HUSK.

			ozs.	grs.
Water from	1 lb. of	rice	2	70
Gluten	,,	,,	1	17
Starch	,,	,,	11	380
Sugar	,,	,,	0	27
Gum	,,	,,	0	68
Fat or oil	,,	,,	0	48
Woody fibre	,,	,,	0	230
Ashes	,,	,,	0	34
Carbon in 1 lb. of the above substances			6	0

In the case are also exhibited samples of rice from Central Africa, Carolina, Cochin-China, Damietta, Egypt, Greece, India, Java, Madagascar, Peru, Portugal, Russia, Spain, Turkey, and another specimen which is of exceeding interest to us—viz., one grown in the Royal Gardens at Kew.

Rice, with proper management in cooking it, forms one of the most valuable of our "farinaceous"* foods; and in years of scarcity has been found to take the place of flour. When boiled, it should not be broken, but should still be soft, and as dry as possible. The water in which rice is being prepared should only *simmer*, but not boil hard. Very little water should be used, more being added occasionally as the rice swells and absorbs it; but if the rice takes up too much at first, it becomes watery. Now all you boys who when you come home to dinner and glory in a rice pudding, just keep on your best manners whilst I tell your sisters how to bake or boil one for you; nor will this knowledge hurt boys, and if any of you have in the course of your life to travel, you may find such information very useful. So now attend whilst I tell you

How to Make a Baked Rice Pudding.

Let me commence by advising you to save orange and lemon peel and keep it by you. Now take one teacup full of rice, and soak it for about three hours in half a pint of milk. Put it in a pie-dish with a teaspoonful of sugar; pour in another half pint of milk, and add half an ounce of butter, and stir the whole about. Grate a little of the dried orange or lemon peel or cinnamon over the top, or, if you like, before doing this, spread an egg well beaten up over it, and bake in a moderate oven from one and a half to two hours. If the rice is first boiled it will be all the better and take so much less time baking; anyhow, the cooking must be very slow, so as to allow the rice to swell.

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* *Farinaceous.* From *farina,* "meal or flour." Latin.

The cost is—best rice, 3d. per lb.; milk, 2d. per pint; butter, 1s. 4d. per lb. This is sufficient for five or six children, and the price is about 7d.

To Make a Plain Boiled Rice Pudding.

Having washed the rice, tie it up in a cloth, not too tightly, so that it may swell, and put it into cold water. If you have soaked the rice in milk and water for two hours before, so much the better. Boil it gently for two hours, and if after a time the cloth seems tied too loosely, take the pudding up and tighten the cloth. A few raisins may be mixed with the rice. *I have even known some children who have thought this an improvement.* When the pudding is done, serve it up with sauce made of half a pint of boiled milk, thickened with a little flour, and flavoured with grated lemon or orange peel, or it may be eaten with jam or marmalade; and if your brothers do not like this, it is because they do not know what is good.

Rice Milk.—Thoroughly wash the rice in three separate waters, and let it soak for about two hours. You will find that several worm-eaten or rotten grains will float at the top of the basin, and these may be removed with a spoon.

Now place the rice in a large saucepan nearly full of water, and let it boil until it is quite tender. You can try whether it is so by pressing a grain or two between your fingers; and this is important, for if a child eat as much rice as it likes, which was not sufficiently soaked before being eaten, it will swell in the child's stomach and cause not only pain and inconvenience, but may be dangerous. Pour the water off the rice, and pour on it the milk which has just boiled, with sugar. It will make it still more agreeable if you add some grated cinnamon. Or you may boil some pieces of whole cinnamon with the milk.

Quantity: quarter of a pound of rice, three pints of milk, two ounces of sugar.

Another important starch, which I do not doubt many of you have often eaten, is that known as **Arrowroot**, of which there are various kinds, the most important being the West Indian and the East Indian.

The West Indian Arrowroot is a very fine starch. It is produced by a number of plants called **Maranta**, growing in tropical America. The starch exists in the rootstems, or rhizomes, of the plant, which are afterwards taken up and beaten in wooden mortars. The milk-like fluid thus pressed out is then passed through a fine hair sieve, and the white powder that settles to the bottom is the arrowroot, which is packed into cases and sent away. We receive the best arrowroot from Bermuda. The East Indian Arrowroot is the starch obtained from the **Turmeric** plant, from which a yellow colouring matter used in dyeing is obtained. From the sides of the rhizomes grow out stalks, at the end of each of these is a ball called the "tuber," filled with the starch, which is collected in the same manner as the West Indian Arrowroot.

About 400,000 lbs. of arrowroot are imported into England every year. As an article of food it is often prepared for invalids and children by first stirring it up with a little cold water, and then adding boiling water. The grains then expand gradually, and a beautifully smooth jelly-like food is formed, which may be flavoured with lemon-juice, wine, or brandy, as circumstances may require.

It was formerly thought that arrowroot possessed a great deal of nourishment, but doctors are now of opinion that such is not the case.

Miss Florence Nightingale, in her "Notes on Nurses and Nursing," says, "Arrowroot is a grand dependence of the nurses. As a vehicle for wine, and as a restorative quickly prepared, it is all very well; but it is nothing but starch and water: flour is both more nutritive and less liable to ferment, and is preferable wherever it can be used.

Tapioca is another starch, obtained from a plant growing in the Brazils called Manihot; it is easy of digestion, and therefore, although not flesh-forming, is often given to invalids, and makes very nice puddings.

Sago is a form of starch found in many plants. The Sago used in Europe is obtained from the Sago palm, which grows in the islands of the Indian Archipelago.

I have already told you that wheat and the other cereals contain starch, but as these grasses have been spoken of under the head of flesh-formers, it is unnecessary to do more than mention them here; and now for our much-liked

Potatoes.—The history of this favourite article of food has been given in "The Uses of Plants," and I refer you for it to that little book; I will only mention here that it is a native of Sub-tropical America, where it seems to have been used as an article of food long before the discovery by the Europeans. It seems to have been first brought to Europe by the Spaniards in the beginning of the sixteenth century, and to have spread from Spain into the Netherlands, Burgundy, and Italy. It derives its name from the "batatas," or sweet potatoes which are eaten in the East Indies and America.

Potatoes were introduced into Ireland by Hawkins, a slave-trader, in 1565, and into England by Drake in 1585; but they were not much noticed. Again brought here by Sir Walter Raleigh, it was still, however, very long before they became generally used.

The part of the plant used for food is the tubers, or underground stems. On these, buds, called "eyes," are formed, which are cut out and planted.

You will perhaps be surprised when I tell you that potatoes, these hard solid-looking balls, are *three-quarters water*, in fact it is this which gives them their weight, for in a pound of potatoes there are 12 ounces of water. You would soon find this out if you were to weigh a potato before you put it into the oven and again after it is roasted; but even then *all* the water would not be dried out—at least, not if you meant to eat the potato.

The potato contains very little nourishment. There is in 100 lbs. of potatoes only 1½ lb. of flesh-forming material. They are thus not fit to be used as a separate article of food, and should therefore be eaten with meat, or, as in some parts of Europe, with curds, buttermilk, or cheese.

The case in the Food Collection at South Kensington exhibits the

INGREDIENTS CONTAINED IN ONE POUND OF POTATOES.

1 lb. of fresh potatoes contains 75 (¾) per cent. water.
1 lb. of potatoes after the water has been dried out, 4 ozs.

The quantity of water obtained from 1 lb. of potatoes	12 ozs.
The albuminous matters in 1 lb. of potatoes	100 grs.
The starch in 1 lb. of potatoes	219 grs.
The sugar in 1 lb. of potatoes	223 grs.
The dextrine or gum in 1 lb. of potatoes.	30 grs.
The fat in 1 lb. of potatoes	15 grs.
The woody fibre in 1 lb. of potatoes	22 grs.
The mineral matter in 1 lb. of potatoes	64 grs.
The quantity of carbon in 1 lb. of potatoes	2 ozs.

You will notice that amongst the substances named above are "64 grains of mineral matter," and will wonder what mineral matter can possibly be contained in potatoes. Well, the principal one is salts of potash; and this is found to be a very necessary ingredient in food. So you see that although the potato does not contain as much nutriment as many other articles of food, it still fulfils other purposes, and its influence on health in this way may perhaps be the reason of its having become so generally adopted in this country, although naturally a stranger to our shores. I shall tell you more about potash when speaking of mineral food, and I have given you more particulars as to the potato in the volume on plants to which I have already referred.

Besides its value in food, however, the potato is useful in trade; its starch is very easily separated, and in large quantities, and it is therefore cheaper than other kinds. It is manufactured on a large scale both in this country and on the Continent.

It is principally used in manufacturing woven fabrics under the name of farina, which is converted into dextrine or British gum. In Holland and in Russia, where there is a difficulty in keeping potatoes over the winter, and there is consequently the necessity for using the crop quickly, large quantities of starch are made, and this again is converted into sugar or syrup. The very refuse of the starch manufactories is used, it is pressed out from the water, and either employed for pig-feeding or for manure. In the North of Europe much spirit for drinking is made from potatoes, called potato brandy.

You may perhaps be surprised to learn that this very useful family has some very dangerous relations—the bittersweet, the belladonna or deadly nightshade, the henbane, and the thornapple. You will find these described and drawn in "The Uses of Plants."

Potatoes are cooked in many ways; but the water in which they are boiled should never be used in food, as it contains juices which are unhealthy.

The quantity of potatoes consumed in the United Kingdom is about ten millions of tons annually.

Potatoes should be put in cold water when they are to be boiled; when you think they are nearly done (and you can try them with a fork) pour off the water and drain them thoroughly; put the saucepan on the hob again, with a clean cloth or flannel over them, and the lid not quite closed; by this means all the water will dry out of them. They should be sent to table in a vegetable dish with a small hole in the lid. This allows the steam to escape instead of condensing; that is, turning into water, which would run down on to the potatoes again. Potatoes boiled in their skins, or, as they are termed, their jackets, are great favourites, as are also potatoes steamed and roasted. I must refer you to *Cassell's Household Guide*, for information on the various questions of cookery, but I strongly urge you little girls not to think that cooking consists in getting up fine dishes, but to learn how to prepare a plain joint, and how to cook a simple potato, and how to provide a wholesome and economical meal, before you attempt anything else.

CHAPTER XII.

Of Heat-giving Food (*continued*).

I HAVE no doubt you have been told that **Sugar** is obtained from the "sugar-cane," but although the plant from which we receive sugar is generally called a cane, I must tell you that this is not a correct name, for it is a very large *grass*, which grows sometimes twenty feet high, with leaves twice as broad as a man's hand, and double as long as his arm. I have, in other books, explained to you the difference between a cane and a grass—namely, that in the cane the fibres run all the way up throughout the whole thickness, whilst in the grass they form a kind of tube, divided into compartments by plates, called nodes, or joints from which the leaves spring. I have, in "The Uses of Plants," told you about the growth and manufacture of sugar, and will now give you some further information on the subject.

There are several kinds of sugar. One is called milk-sugar, and is obtained from milk. Sugar is also contained in the livers of animals; then there are the sugars obtained from fruit and from starch; but the sugar which we generally use to sweeten our food is, as I have told you, obtained from the sugar-cane. This kind of sugar is contained in the stems of some plants and the roots of others, thus we have beetroot-sugar, &c. Now, these sugars are by chemists called by different names—thus, cane-sugar is called *sucrose;* sugar obtained from fruit, *fructose;* milk-sugar is called *lactose;* and starch-sugar is termed *glucose.* Of the use of sugar in food, Dr. Lankester says:—"The ultimate action of all sugar on the system is the same. We have seen that starch can only be absorbed as it is converted into sugar. The advantage, then, of sugar over starch as an article of food appears to be the facility with which it can be absorbed into the blood. It is supplied to the young of all the higher forms of mammalia in their mothers' milk, and its sweetness seems adapted to the instinctive tastes of children, who may always with advantage be allowed a free use of it in their food. At the same time, what is good for children may not be so advantageous to fathers and mothers. Sugar readily enters into decomposition, forms other compounds, especially lactic acid, and sets in operation other dangerous changes in the food. Hence the dyspeptic,* the gouty, the rheumatic, and the corpulent must be warned against it."

The trade in sugar is something immense, and is daily increasing. It comes to us from the West Indies in large casks, called hogsheads, and in smaller ones called "tierces;" from the East Indies in bags made of jute hemp, called "gunny bags;" from Havannah in large boxes; from Manilla in calico bags; from Mauritius in mat-bags; and from the Brazils in large chests.

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* Persons who suffer from indigestion.

Molasses, or treacle, is the juice from the sugar-cane which will not become firm, and turn into the little crumbs called crystals, so that it is said not to "crystallise." It is used in various ways, and when spread on bread and given in proper quantity is very good for most children.

The quantity of sugar of all kinds imported into Britain in 1864 was 536,226 tons unrefined, 14,879 refined, and 40,165 tons of cane-juice, syrup, and molasses, the total value of all of which was about £12,400,000 (twelve millions four hundred thousand pounds sterling).

Oils and Fats.

The next kind of heat-giving foods are those classed as oils and fats, and these exist in both animals and plants, and are accordingly called animal fats or vegetable fats.

Fat serves various purposes in the animal system: first, to protect the body from shocks, by a uniform spreading of the pressure through the whole fatty tissue; secondly, it keeps in the heat of the body, being what is called a bad conductor of heat, it prevents the warmth escaping. This purpose is plainly visible in creatures such as the whale, in which the animal fat known as "blubber," is imbedded in the very substance of the skin, and so not only enables the whale to bear the enormous pressure of the surrounding waters, but also preserves the internal warmth whilst exposed to the intense cold of the Arctic Seas. Fat also forms a pad or cushion in which certain organs move, as in the orbit of the eye, &c.; it also diminishes the brittleness of the bones. Fat becomes a heat-giver when taken as food, because, when it mixes with the oxygen of the air we breathe, a quantity of heat is set free; and thus, when fat has accumulated in the body, it serves, as it were, as a stock of fuel to be burned as required. This occurs in those amimals which hybernate, that is, sleep over the winter, as the Bear, the Marmot,* &c. During that period the heat is supplied to their bodies by the fat they have accumulated; but this after a while gets used up, and when they make their next public appearance they are sadly thinned down.

An excessive accumulation of fat is, however, likely to interfere greatly with health, and therefore such food as promotes the formation of fat should not be taken in excessive quantities.

I dare say you have noticed that when a bottle of oil is exposed to great cold the oil separates into two parts, the one solid, which has been called **Stearine,** the other fluid, termed **Oleine.** Oleine is always liquid, but Stearine only becomes so when exposed to heat. All fats and oils contain either one or both of these substances. They may be solid and hard, like suet; semi-soft, like butter and lard; or fluid, like the oils. The solid and semi-solid are generally placed together and are called fats, whilst such as are fluid are termed oils.

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* "Animal Kingdom," Cassell's Primary Series, pages 71, 73.

Vegetable Oils.—These are widely distributed throughout the plant world, there being scarcely any vegetable tissue that is entirely without them. But they are especially abundant in the seeds, linseed yielding 20 per cent. of oil; some fruits also, as those of the olive and palm, yield abundance of oil. The olive is, in fact, the source of the greatest amount of vegetable oil used as food. The Cocoa-nut palm and the cocoa or chocolate plant also contain much oil.

Animal Fats.—The chief solid fats are:—Suet, Lard, Butter, Goose-grease. Whilst amongst the fluid fats, are Olive, Sperm, Whale, Cod-liver, and Neats'-foot oils. All these are called "fixed oils," because they do not easily evaporate or dry away. Whilst others, such as oil of lavender, oil of nutmeg, and oil of cinnamon, are called "volatile" oils, because they evaporate or fly away in vapour very speedily.

Now you must understand, that before we can really obtain the use of fat in our system, it has to be changed and changed again. You have read in "Our Bodies," how the Lacteals, or absorbent vessels, suck up the milky juices which are the proceeds of digestion, and convey them to the Thoracic duct, so that they may be mixed with the blood.

Now the fat we take in food, could not be carried into the blood, for the globules of fat could not pass into the absorbent vessels—because nothing that cannot be dissolved in water can pass into the lacteals—the fatty acid therefore combines with other matters in the stomach, and is formed into a compound, which is soluble. By this means it is taken up into the blood, is there again turned into an insoluble substance, and is thus deposited as fat.

The "Vegetables" used as Food.

As the plants known as "vegetables" contain both nutritive and heat-giving properties, I will briefly mention a few of them before proceeding to another section of our subject.

The Cabbage and its allies are especial favourites and contain a certain amount of nourishment, but should be eaten with fat or oily food. Hence the custom of taking fat smoked meats with greens. By boiling, we extract the greater part of that which is disagreeable to the taste or smell, and convert it into a most palatable food without diminishing its nutritive qualities. The ingredients contained in 1 lb of cabbage, as shown at South Kensington, are as follows:

	ozs.	grs.
Water	14	414
Albumen	0	126
Starch	0	42
Dextrine	0	203
Woody fiber	0	35
Ashes	0	56

The Cauliflower, Kale, Greens, Savoy, Brussels sprouts, Brocoli, and the Turnip belong to this family. I will tell you about the turnip presently.

The Onion is very extensively used in this country, but still not so much so as on the Continent of Europe. We grow immense quantities of it at home, but import seven or eight hundred tons from Spain and Portugal, in which countries it is an absolute article of food, forming one of the common supports of life. According to Professor Johnstone's analysis, the dried onion root contains from twenty-five to thirty per cent. of gluten. It is not merely a relish, therefore, to the poor Spaniard when he eats it with his crust of bread, but it really adds to the amount of nourishment he receives from his simple meal.

Carrots.—The carrot is a plant common in Britain and most parts of Europe, and is universally cultivated, not only in Europe and European colonies for the sake of its root, but also in China and Cochin-China. The carrot appears to have been cultivated at an early period in Flanders and Germany, and to have been introduced into the gardens of England in the beginning of the sixteenth century. In the reign of Charles I. ladies wore the leaves of the carrot as an ornament instead of feathers—and a very handsome ornament, too, for they really look like bright green feathers—but, of course, soon fade and droop. I may just tell you that if you obtain a carrot with the green top to it, and cut off the top with an inch or two of carrot, it will, if this part be placed in a dish of water, spread out, and keep green and fresh for several days, and will adorn your room when flowers are scarce.

As an article of food, the Carrot contains a large amount of what are called heat-producing compounds, and a small proportion of flesh-forming matter. The following are the

INGREDIENTS CONTAINED IN ONE POUND OF CARROTS.

	ozs.	grs.
Water	14	0
Albumen	0	42
Sugar	1	11
Fat	0	14
Gum	0	70
Woody fibre	0	231
Mineral matter	0	70

Carrots when very well boiled are easy of digestion, but not otherwise. Carrots, Turnips, and other vegetables which contain such a large proportion of sugar, are found very useful in soups and stews, for this reason: if you boil meat in water so as to form the basis of the soup, of course the fat will rise to the top. Now, although the cook will skim off much of this, still, after what I have told you about the uses of fat in food, you will understand that it is necessary that some of it should remain; but, as we know, fat will not mix with water, and therefore these plants act as a medium; for as the sugar boils out of the vegetables, it causes a certain portion of the fat to be retained in the soup.

Parsnips belong to the same natural order as carrots; but on account of the greater amount of woody fibre in them, are more indigestible. They contain more woody fibre and starch, less water, and more nutritive matter, and less sugar than either carrots or turnips.

The following are the ingredients contained in 1 lb. of parsnips, as exhibited at South Kensington:

	ozs.	grs.
Water	13	53
Albumen and caseine	0	87
Sugar	0	210
Starch	0	245
Fat	0	35
Gum	0	52
Woody fibre	1	123
Ashes	0	70

With this explanation before you, you will easily see how it is that people are in the habit of eating Carrots with salt beef and Parsnips with salt cod.

Turnips.—The Turnip is a native of Europe, the temperate parts of Asia, and has long been cultivated in Britain. The Turnip contains large quantities of water, but has more nutritive matter than the Carrot. The dried meal of the Turnip is, in fact, equal in this respect to the meal of Indian corn; but is deficient in fat. This is why it is usual to eat turnips with boiled mutton, in which there is a great deal of fat. The young leaves of the turnip are good as greens, particularly those of the Swedish turnip, a very large kind, the root of which is principally used as food for cattle, but is eaten by many country people. The turnip, owing to its possessing less woody fibre than the carrot or parsnip, is more digestible.

In the "Library of Entertaining Knowledge" we find—"It is recorded that in the years 1629 and 1630, when there was a dearth in England, very good, white, lasting, and wholesome bread was made of boiled Turnips, deprived of their moisture by pressure, and then kneaded with an equal quantity of wheaten flour, the whole forming what is called Turnip Bread. The scarcity of corn in 1693 obliged the poor people in Essex again to have recourse to this species of food."

The following are the

INGREDIENTS CONTAINED IN ONE POUND OF TURNIPS.

	ozs.	grs.
Water	14	213
Albumen and caseine	0	77
Sugar	0	280
Gum	0	107
Woody fibre	0	168
Mineral matter	0	35

As I have described numerous other "Vegetables used as Food" in "The Uses of Plants," I will not dwell further on them here, and will only tell you what Professor Johnstone says of vegetable food.

"Such are the principal varieties of vegetable food, which partly in the form of baked bread, and partly cooked in other ways, are at the present day most largely employed in the feeding of the human race."

We have seen in all of them—

1. That they contain a sensible proportion of three important constituents—Gluten, Starch, and Fat.

2. That when the proportion of any of these is too small, chemistry indicates and experience suggests that an additional quantity of this deficient substance should be added during the process of cooking or preparatory to eating.

Thus we consume butter with our bread, and mix it with our pastry, because wheaten flour is deficient in fat; or we eat cheese and onions with our bread, to add to the proportion of gluten it naturally contains. So we eat something more nutritive along with our potatoes or rice; we add fat to our cabbage; we enrich our salad with vegetable oil—eat our cauliflower with melted butter, and beat up potatoes and cabbage together into a nutritious "kolcannon."

3. That in all natural varieties of vegetable food which are generally suitable for eating without cooking, a large per-centage of water is present. In preparing food in our kitchens, we imitate this natural condition. Even in converting our wheaten flour into bread, we, as one important

result aimed at, mix or unite with it a large proportion of water.

All the kinds of food by which the lives of masses of men are sustained being thus constituted, it is obvious that those vegetable substances which consist of one only of the constituents of wheaten bread, cannot be expected to prove permanently nutritious, and experience has proved this to be the case. The oils or fats alone do not sustain life, neither does starch or sugar alone. With both of these classes of substances, as we have seen, a certain proportion of gluten is associated in all our grains, fruits, and nutritious roots.

Hence Arrowroot, which is only a variety of starch, cannot give strength without admixture of gluten in some form or the other. To condemn a prisoner to be fed on arrowroot only, would be to put him to certain death, by a lingering, torturing starvation. The same is true, to a less extent, of Tapioca, and of most varieties of Sago, all of which consist of starch with only a small and variable admixture of gluten.

Even gluten, when given alone to dogs, has not kept them alive beyond a few weeks; so that no vegetable production, it may be said, and no kind of artificially-prepared food, will support life in which at least starch and gluten are not united. If they contain at the same time a certain proportion of fat, they will admit of more easy digestion and of a more ready application in the stomach to the purposes of nutrition; and if they contain naturally a large quantity of water, or are mixed with it by artificial means, they will dissolve more easily and completely in the alimentary canal, and will produce the greatest possible effect in administering to the wants of animal life.

CHAPTER XIII.

Mineral Food.

Water.—Although water is not in itself a mineral, still its solvent power—that is, its power of separating the atoms of other substances—is so great that it conveys to us several mineral matters which in a solid state we could not take.

You will understand how necessary water is to us when I tell you that in a human body, weighing 154 lbs., 111 lbs of that weight will consist of water; and in some animals the proportion is even greater. The celebrated naturalist, Professor Owen, weighed a jelly-fish, and found that just after it came out of the water its weight was two pounds; he dried it in the sun, and then it weighed only *sixteen grains;*—that is to say, the animal was made up of sixteen grains of solid matter, all the rest of the weight being water.

Again, plants would soon die were it not for water, for their food could not pass up through the minute tubes which form their stems, were it not dissolved in great quantities of water; this passes from the ground into the roots, is carried up the numerous ducts, and then the superfluous water is evaporated by the atmosphere from the surfaces of the leaves.

It will prove to you that people really require water, when you remember that when you feel "dry," or thirsty, it is because the food you have taken contains very little water; or, that it dries up the tissues. Thus, in 1847 there was a potato famine in Ireland, and behold, the people all of a sudden began to take much more tea, coffee, sugar, and cocoa than they had formerly done. Now, as these things are by far more expensive than many other articles of food, this created some surprise; but it was afterwards explained. As the people could not get potatoes, they took to corn, maize, Indian meal, and rice, neither of which contains as much water as the potatoes; so, feeling the want of more water, they took to tea, coffee, and cocoa, which they had not before been used to.

Now, although I have given you the weight of each of the separate ingredients existing in various articles of food, I will here compare the amount of water they contain.

		ozs.	grs.	
1 lb. of Wheaten Flour	contains	2	106	of water.
1 lb. of Oatmeal	,,	2	78	,,
1 lb. of Barley	,,	2	106	,,
1 lb. of Rye	,,	2	35	,,
1 lb. of Peas (air dried)	,,	2	112	,,
1 lb. of Lentils	,,	2	105	,,
1 lb. of Beef	,,	8	0	,,
1 lb. of Mutton	,,	7	16	,,
1 lb. of Fowl	,,	12	107	,,
1 lb. of Fish (Soles)	,,	13	374	,,
1 lb. of Rice	,,	2	70	,,
1 lb. of Maize	,,	2	105	,,
1 lb. of Carrots	,,	14	0	,,
1 lb. of Parsnips	,,	13	53	,,
1 lb. of Potatoes	,,	12	0	,,
1 lb. of Turnips	,,	14	213	,,

From the above you will see that even substances which we are accustomed to think of as quite solid, contain certain quantities of water, and the action of this liquid is most important to us. Water dissolves everything we take as food, for not anything is fit to give us nourishment that will not dissolve in it; and I have already told you that as the starch which it is necessary for us to take would not dissolve in water, it is in the mouth changed into sugar, and thus becomes readily soluble.

Now it will be clear to you, that the more pure water is, the greater will be its power of dissolving other substances, and therefore a certain portion of clear water should be drunk every day. At meals, especially, pure water is the best drink, for no other beverage would have such power to dissolve the food we take; in fact, all other drinks are so much water part of the solvent powers of which are spoiled by other substances having previously been mixed with them.

But this very power of dissolving other substances, causes water to be often very impure, and consequently unhealthy; for, as it passes over rocks and through the soil, it gathers decomposed matter and filth, and carries them into the wells and rivers, from which the water we drink is obtained, and so becomes a source of danger and disease.

The rain which falls in the neighbourhood of towns washes out all the soluble substances from the refuse matter that has been allowed to collect; the water sinks into the ground, and in time reaches the sources whence the supply of water is drawn.

One of the best things you can do with water in order to purify it is to boil it. Some water contains albumen from decayed vegetable matter, and you will remember that albumen congeals by heat and will sink to the bottom, and then the water so purified can be poured off from the top.

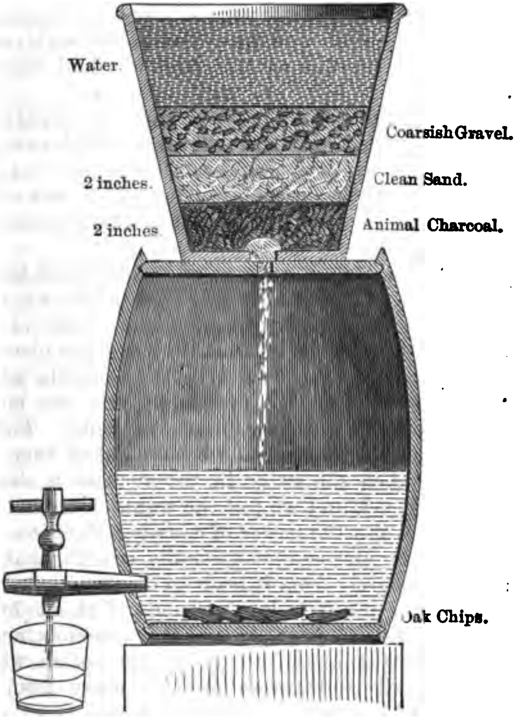
Or, albumen is congealed by tannic acid, and you will be able to try this in a very easy manner.

Take a tumbler of cold water and mix up in it a little white of egg; drop into the glass some cuttings of new oak, or a little tannic acid (which is obtained from oak), which you may buy at the druggist's, and it will at once coagulate the albumen, causing it to settle to the bottom, and not only this, but as it falls it carries other impurities along with it. It is in this way that the white of egg is used in clarifying wine and other liquids.

The waters of many rivers and swampy countries often contain a similar albuminous substance. The water of the Seine at Paris is clarified by a small quantity of alum. In some parts of India travellers carry with them a supply of a bitter nut, and when they are going to drink they rub these nuts to powder on the inside of their earthen drinking-vessels, which causes the impurities to subside. In Egypt, the muddy waters of the Nile are purified in the same way.

The next method of purifying water is by filtering it, and I will tell you how to make a very useful and cheap filter.

Obtain a small barrel, which must be well cleaned out; bore a hole in the head, about as large as a halfpenny (this may easily be done with a carpenter's brace and bit), and another in the side, about three inches from the bottom, in which fix a small wooden tap, the cost of which is about threepence, and in the bottom of the barrel throw a few oak-chips. Next get a good-sized flower-pot (those known as the "twelve inch" are the best for the purpose. Plug up the hole in the bottom of the pot with a piece of sponge, and place a layer of animal charcoal (which you can obtain for a few pence at any wholesale druggist's) about



A SIMPLE FILTER.

two inches thick. Then a layer of clean sand, and on this a layer of gravel; press all down, and place the flower-pot on the barrel so that the hole of the pot is immediately over that in the head of the barrel. Pour in the water, and as fast as it sinks pour in more. On turning the tap you will be surprised to find that you will obtain a glass of pure water, clean and fit to drink, although what you poured in was of the muddiest and dirtiest character.

As a useful and common precaution, too, all the taps in a house from which water is drawn for cooking or drinking purposes, should have a piece of flannel tied round them. This will arrest much animal and vegetable matter, that would otherwise pass into our food.

Salt.—A certain amount of salt is found in the blood, and it is the only substance which we take directly from the mineral kingdom. One of the uses of salt seems to be that it causes the blood to be thicker than the liquids in the stomach, which then pass through the membrane into the blood, and so water is absorbed into the system.* This is why we feel thirsty when we have taken very salt food, for then the water in the stomach is drawn into the blood, and we feel the want of more.

Salt has also the power of assisting digestion, and its effect on the system generally is such, that abstaining entirely from it leads to disease.

But too much salt provisions, without other mineral food, is not good; and it is therefore necessary that we should take what is called potash, which exists in all land plants growing away from the shore. I have told you that potatoes contain salts of potash, so do asparagus, radishes, turnips, carrots, parsnips, &c., and this is why we should take every day a certain quantity of fresh vegetables, such as watercress, lettuce, &c.

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* The principle by which liquids absorb others thinner than themselves is called Endosmose. See "Our Bodies," page 56.

Persons who live principally on salt provisions are liable to a disease called scurvy, which was at one time very frequent among sailors, from their eating so much salted meat and so little fresh vegetables; and this same disease broke out again during the potato famine.

About 1780 Sir Gilbert Blane discovered that lemon-juice would cure this malady; since that time all ships are provided with lemon or lime juice; and now potatoes, carrots, cabbage, and turnips are so preserved that they are taken about to all parts of the world. So you have here two instances of how, by the grace of God, men have been able, by means of science, to preserve the health and lives of their fellow-creatures.

Another important mineral food is **Phosphate of Lime**, or bone earth: this exists in all the animal tissues of the body, and forms, as you have already seen,* the leading material of which our bones are formed; in fact, about fifty-nine parts out of a hundred in our bones consist of this substance. We obtain it from all flesh-forming food, but principally from the Cereal grasses and Caseine.

Carbonate of Lime, or chalk, is another mineral substance which is required in forming our bones; but not in such quantities as the phosphate. It is the material of which coral and the shells of oysters, &c., are formed; you can therefore very well imagine that much of it is contained in water, and thus it reaches our system; but beans and peas also possess it, and this is the reason that the leguminous plants flourish best in chalky soils.

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* "Our Bodies," page 5.

Numerous other mineral matters exist in our bodies, and of course are obtained from the various articles of food we take. I can only here afford space to briefly mention, **Iron**, which is found in the blood, gastric juice, hair, &c. **Fluoride of Calcium**, or fluor-spar, exists in small quantities in the animal tissues, and principally in the bones and teeth; and **Silica**, or flint, is found in the enamel of the teeth and in the hair.

Further information on this branch of our subject must be reserved for a future opportunity. I must, however, repeat that the opinion of some of our highest authorities is, that a certain amount of uncooked fruit and vegetable food should be taken daily. This is necessary, because in boiling we get rid of some of the mineral matters contained in vegetables. For an account of the lettuce and other plants used as salads, I must refer you to "The Uses of Plants," page 58, &c., and the whole subject of fruits will be treated of in a separate volume.

CHAPTER XIV.

Accessory or Helping Foods.

THE first of these which I shall mention is **Gelatine.** Although this substance exists in our bones and other animal tissues, it seems certain that it is derived from others containing albumen, because it is found that animals fed on these alone go on forming their gelatinous tissues just the same; but it is equally certain that life could not be supported on gelatine alone, since it cannot be applied to the nutrition of the albuminous tissues. Dr. Carpenter says, "Many series of experiments have been made on this subject, with the view of determining how far gelatine soup, made of crushed bones, such as that which long constituted a principal article of diet in the hospitals of Paris, is adequate for the support of the body in health. The result of these has been uniformly the same; namely, that although gelatine may be advantageously mixed with albumen, fibrine, gluten, &c., and those other ingredients which exist in meat, soup, and bread, yet that, when taken alone, it has little, if any, more power of sustaining life than sugar or starch possesses. Although it might have been thought likely that gelatine employed as food might be applied within the body to the nutrition of its gelatinous tissues, yet there is strong reason to believe that these, like the albuminous, are formed at the expense of the albuminous matter of the blood, and that gelatine thus introduced undergoes a rapid decomposition. *Consequently, the current idea regarding the nutritive value of jellies* has little or no real foundation."

I have told you of **Cellulose**, or woody fibre, on page 83; it forms the frame-work of all plants. You can therefore imagine that we consume some quantity of it in the vegetable food we take; it is not, however, digestible, and unless softened by boiling, or if eaten in an unripe condition, or in too great quantities, it would prove injurious to us—otherwise it is found to help other food—for you will have learnt in "Our Bodies" that the presence of a certain amount of solid matter in our stomach is necessary for the proper action of the system.

Gum.—This is a juice found in the bark and wood of all plants, and some trees contain so much of it that it bursts forth from every crack or wound in the bark. I dare say you have seen this in some plum or cherry trees. The gum most generally known to us is that called Gum Arabic, which, as its name tells you, comes principally from Arabia; but many other gums come to us from warm climates. A large quantity is imported into this country to be used in calico-printing and other manufactures.

Gum was formerly thought to be very nutritious, but this has been found to be a mistake, for it has been proved that animal life cannot be sustained by it for any length of time; it must therefore be combined with other food. Linseed, Quince-seed, &c., contain a kind of gum called Mucilage, or Bassorin, which softens but does not dissolve in water.

Spices and Condiments.

A great number of substances which we add to our daily food are classed under these names, but there is some difficulty in deciding which should be called by the one name and which by the other. It seems, however, to be generally understood that the Spices are used with sugar and the Condiments with salt; but this rule has its exceptions, for Ginger may either be used in flavouring soup or stews together with salt, or may be mixed with sugar and gum and made into lozenges.

Spices and condiments owe their flavouring power to the presence of a volatile oil (see page 98), and when taken into the stomach they excite the mucous membrane, and also stimulate the nervous system.

Spices are obtained from various parts of plants; from the fruit, as in Pepper, Nutmeg, &c.; from the root, as in Ginger; and in some cases from the bark, as in Cinnamon.

The principal spices and condiments are Cinnamon, Nutmeg, Cloves, Allspice, Pepper, Mustard, Ginger, Aniseed, Caraway, Coriander, and Vanilla, also Thyme, Marjoram, Mint, Sage, and Rosemary.

In "The Uses of Plants" I have given you a full description of the growth, history, and mode of gathering most of these, and must therefore advise you to read further about them.

Vinegar, one of our leading condiments, is obtained from fermented malt or wine, which from its agreeable flavour has become generally used. The power it possesses of preserving vegetable substances has led to the manufacture of pickles. These are agreeable as relishes with cold meats, &c., but should only be taken in small quantities. Vinegar too, although beneficial when used in moderation, is injurious if taken too freely, as it destroys the digestive power of the stomach and thins the blood.

Drinks.

Drinks are merely liquid food, and therefore consist of some one or more articles mixed with a large quantity of water. Most of the substances so used have already been referred to, and we can devote the little space remaining to the consideration of those universally adopted drinks, **Tea, Coffee, and Cocoa.**

Tea.—I have in "The Uses of Plants" given you a full account of the growth and mode of preparing these. I will therefore merely here remind you, that the tea is the leaf of a plant which grows chiefly in China, and was first sold in England in 1657, at from six to ten pounds per pound.

I have told you how in 1664 the East India Company obtained a couple of pounds of tea, which they presented to the King; and how the royal cooks, not knowing what to do with it, boiled it like spinach, and served it in a dish with pepper, salt, and butter, and, as we can very well imagine, *nobody liked it.* But in spite of this, the East

THE TEA PLANT.

India Company in 1667 ordered 100 lbs. of tea, and in the very next year the use of it had so increased that they ordered 4,713 lbs.

At this moment, as far as it can be ascertained, about *five hundred millions of men, or half the human race, use tea.*

In the United Kingdom above thirty-two thousand tons, or seventy-three millions of pounds are used every year, or rather more than two and a half pounds for every person in the kingdom.

It was at one time thought that black and green teas were made from different plants, but this is not the case; there are certainly two sorts of the plant, but black or green tea may be made from either; the difference being caused by the method of preparation. To make black tea, the leaves, after being gathered and sorted, are thrown into a heap until a change sets in, and they become warm and soft. They are then twisted between the fingers, and are roasted over a charcoal fire in a sort of roller made of basket-work. They are then returned to the bowls, are again twisted, rubbed, and sifted; lastly, they are roasted again over a very slow fire, and so become black and crisp.

The principal varieties of black tea are Bohea, Congou, Pekoe, Souchong, and Caper.

Green tea does not undergo the heating process, but the leaves are at once roasted over strong charcoal fires, in large pans called *kuos.* Whilst they are being thus roasted, they are constantly stirred up and twisted, and the steam which rises up is fanned away.

The following list of ingredients contained in 1 lb. of tea as exhibited at South Kensington will be interesting to you:—

1 lb. of tea contains—

	ozs.	grs.
Water	0	350
Theine	0	210
Caseine	2	175
Aromatic oil	0	52
Gum	2	385
Sugar	0	218
Fat	0	280
Tannic acid	4	87
Woody fibre	3	17
Mineral matter	0	350

The chief action of tea depends on the soothing and cheering properties of some of the above ingredients; and on the peculiar principle which these drinks contain, called *theine* in tea and *caffeine* in coffee. This theine excites the brain to increased activity, but retards the consumption of the food in the system, and so economises the use of food. It has the remarkable effect of diminishing the waste which goes on in the system, and therefore saves food (because if the waste is less, the amount of food required to supply that waste will of course be less), whilst at the same time it soothes the body and enlivens the mind.

I do not, however, mean that by taking tea you would do away with the necessity of eating, or that you would be right in taking too much of any substance which would prevent the natural waste going on in the system. It is this very circumstance of tea preventing your taking other and more nourishing food, which shows us that we should not take too much of it, and that we should not take it shortly before other meals. Nor is it right to drink strong tea together with animal food, because the tannic acid in the tea has, as you know, the power of coagulating the gelatine and the albumen, and thus causes indigestion. This is the objection to what are called tea-dinners; but taking tea two or three hours after a meal, when the digestion is too far gone to be interfered with, is beneficial, and as a refreshing drink after fatigue or during mental work, the fragrant cup of tea is invaluable.

THE COFFEE PLANT.

Coffee.—The coffee plant came originally from Abyssinia, and was introduced into Arabia in the fifteenth century. It reached Constantinople in the sixteenth century, and, as I have told you in "The Uses of Plants," the first coffee-house was established in London in 1652. What we call the coffee-bean is the seed of the plant, and when it grows it is wrapped in a covering formed of a tough membrane like parchment, which is again imbedded in a fleshy berry, which is at first green, but which becomes red on ripening. The bean is at first grey, but when roasted becomes a rich "coffee-brown," and as it roasts, the volatile oil and the caffeine (which is the same principle as theine) are developed.

The total quantity of coffee imported in 1859 was 65,353,029 lbs. or nearly 30,000 tons, of which 51,708,901 lbs. came from British colonies, the value being about £1,955,543. We kept 34,328,526 lbs. for our own use and exported the rest.

The following is a list of the ingredients contained in 1 lb. of coffee-beans :—

	ozs.	grs.
Water	1	407
Caffeine	0	122
Caseine (or cheese matter)	2	35
Aromatic oil	0	1½
Gum	1	192
Sugar	1	17
Fat	1	402
Potash with an acid	0	280
Woody fibre	5	262
Mineral matter	1	31

The effects of coffee are, that it cheers, arouses, and keeps awake; it allays hunger to a certain extent, imparting a sense of vigour and comfort to the fatigued and weary. It makes the brain more active, whilst it soothes the body and makes the waste of matter slower and the demand for food consequently less; but when taken in too large quantities, it produces sleeplessness and palpitation of the heart. Its agreeable smell and other of its properties are due to the essential oil it contains, which constitutes only one five-thousandth part of its weight, but which, according to the late Professor Johnstone, would, if it could be manufactured, be worth £100 an ounce. It is on the different proportion of this oil contained in the various kinds of coffee that one is more valuable than the other, for a higher aroma would make the inferior sorts equal to the finest Mocha.

The quantity of caffeine in coffee is less than that of theine in tea, but it contains more sugar, and a good deal of cheese matter (caseine).

Now, however good your tea or coffee may be, you can very easily spoil it in the making, if you do not set about it in the right way, so I will just give you a few hints on this part of the subject.

In the first place, your tea-pot must be hot: this may be managed by pouring boiling water into it, and pouring it away the moment before you are going to make the tea. Then the tea itself must be hot, so you may put it in a cup on the hob and cover it over.

But, above all, the *water must boil* at the *very moment* when you pour it on the tea; so you should not bring the kettle to the table, but should take the tea-pot to the kettle, and whilst the water is boiling, slant the kettle forward, and thus let the water boil out of the spout on to the tea. If you are using an urn on the table, do not attempt to pour the water on the tea unless the steam is coming violently out of the hole on the top of the lid, otherwise you will not extract all the theine from the tea.

Of course, you know that coffee is brought raw to this country, and that it is roasted at coffee-roasters or the grocers' shops. Now, if you can manage it, it is by far the best plan to roast the beans yourselves. Small coffee-roasting machines may be purchased, and I have seen coffee well roasted in a frying-pan.

My reason for mentioning this is because the sooner the coffee is ground after it is roasted the better. It may be ground either in a coffee-mill or a mortar, but you must not use the machine for any other purpose, as coffee has the property of absorbing other smells and tastes, and if you have ground pepper in the mill, you would not find your coffee as agreeable as you would like.

Again, coffee should be used as soon as possible after it has been ground, for, of course, the separate grains part with the volatile oil more rapidly than when they were tightly pressed together in the bean. Ground coffee should not therefore be kept in paper, for the oil soaks through and flies away. It may be kept in a close tin canister, but a glass-stoppered bottle is the best.

There are two ways of making coffee. The first is to boil it for two or three minutes after boiling water has been poured upon it. If then a cup is poured out and returned, and this process repeated, the coffee being then left for a few moments to settle, a good cup will be the result,—or a little isinglass or white of egg may be used to clarify it.

The second method consists in placing the coffee in a muslin bag, which is sold with some coffee-pots, and pouring the boiling water over it; the coffee then drains through the bag, and will be found to have more of the aroma left in it than when made by boiling.

Cocoa.—Cocoa may well be called liquid food, for it contains as much flesh-forming matter as beef and more fat.

The Cocoa plant is a tree with single leaves, and small flowers, which grow on separate stalks direct from the stem.

THE COCOA PLANT.

The flower is followed by a large capsular or *pod-like* fruit, about the size of a common vegetable marrow, and in this the beans or seeds are embedded, wrapped in a thick skin or husk. These beans are used as money in Mexico, six of the beans being worth about a halfpenny.

The following is a table of the

INGREDIENTS CONTAINED IN ONE POUND OF COCOA.

	ozs.	grs.
Water	0	350
Albumen and Gluten	8	85
Theobromine	0	140
Butter	8	0
Gum	0	426
Starch	1	53
Woody fibre	0	280
Colouring matter	0	140
Mineral matter	0	280

The Theobromine is the substance in cocoa which corresponds with the theine of tea and caffeine of coffee.

The distinguishing feature of cocoa is the large quantity of fat and albumen which it contains, so that it acts, not only through its Theobromine, but as a flesh and force producing food.

When brought to this country the seeds are prepared in various ways; they are either heated and ground down in a mill, and a coarse kind of paste made of them, called "cocoa-paste," rubbed into a coarse powder and called "granulated cocoa," or cut into slips and called "flake cocoa." The husks are more or less removed in all these preparations. Or, the seeds are submitted to heat, the husks removed, and the kernel somewhat broken up, and they are then sold under the name of "cocoa-nibs," which is, in my opinion, the best form in which to use this very nourishing food. The nibs require very long boiling, but when milk and a little sugar are added, the cocoa obtained is truly excellent and very nutritious.

Cocoa is prepared in various ways. The paste or powder is boiled with water, and sugar and milk are added according to taste. Chocolate is made of the ground cocoa-beans, all the husks being removed, and vanilla, or some other flavouring matter, being added.

The quantity of Cocoa consumed annually in the United Kingdom exceeds one million seventy-five thousand pounds.

Adulteration of Food.

It is a very unfortunate thing, that in order to make greater profits out of their goods than they would otherwise be able to obtain, a large number of dishonest tradesmen mix various substances with the articles they sell: you cannot therefore be too careful as to where you buy your things.

Groceries are particularly liable to this adulteration, and not only is the purchaser cheated as to the quantity he obtains, but the substance with which the article is adulterated is injurious, and in some cases poisonous.

According to Dr. Hassall's analysis, we find that—

Wheat flour is adulterated, amongst other things, with alum, chalk, plaster of Paris, sand, clay, &c.

Arrowroot is mixed with potato-flour, &c., so much so that out of fifty samples examined by Dr. Hassall, twenty-two were adulterated, and in ten of them there was scarcely a particle of the genuine article.

Sugar of the inferior kinds is adulterated with flour, gum, sand, chalk, and carbonate of lime, &c.

Pepper is adulterated with linseed, mustard-seed, sweepings, &c.

Cayenne pepper is adulterated with red lead, vermillion, brickdust, &c.

Mustard is adulterated with common flour, pea-flour, linseed meal, turmeric, &c.

Ground ginger is mixed with ground rice, flour, &c.

Coffee is very much adulterated. In its powdered form it is mixed with chicory, roasted grain, and *burnt horse's and bullock's liver*. Even whole coffee is not free from adulteration, for it has been discovered that imitation coffee-beans are made of chicory; but this is not general.

Tea is not only adulterated in this country, but is injured by what is mixed with it in China. Mr. Fortune, who saw the colouring process in China, tells us that plaster of Paris and Prussian blue are applied, and we also know that carbonate of copper is used. Blacklead, too, is used to give a glossy appearance to black tea; and a recent trial has shown that cast-steel filings and sweepings are largely mixed with tea.

I cannot here give you rules for testing all these things, but I strongly urge you to be careful in buying your food, &c., only at respectable shops. It is, unfortunately, people of small means, living in the poorer neighbourhoods, who suffer the most, for they are compelled to buy at as cheap a rate as possible, and the shopkeeper therefore adulterates the goods so as to increase the quantity of his stock, and thus be enabled to meet the demand. This is, however, a very short-sighted policy on the part of the poorer classes, and I would urge on you to make this known to all about you, that one ounce of good pure tea or coffee, or any other article, will, as far as use is concerned, be worth any quantity of the adulterated stuff, which, as I have shown you, will not only be weaker, but positively hurtful. It is, no doubt, this demand for excessive cheapness which causes dishonest tradesmen to adulterate their goods, for we find, by the result of an examination, recorded in the *Food Journal*, of forty-seven specimens of coffee purchased in London, that one pound bought at two shillings, and all but two of the pounds bought at one-and-eightpence were perfectly pure. All but two of those purchased at one-and-fourpence were adulterated in a greater or lesser degree, whilst every single sample bought at one shilling per pound was adulterated with chicory, sand, foreign roots, nauseous berries, and other injurious substances.

You can, however, in some cases prevent imposition by buying several things whole, instead of ground, such as pepper, ginger, cayenne, &c., and for the rest, bear in mind that smallness of price is not always cheapness, and that by purchasing food articles because they are "cheap," you may lay up a store of the seeds of disease which will, no doubt, break out in your system at a future day; it is therefore your duty to deal only at such shops as are known for the respectability of their character, and whose goods have been tested and found pure.

It will be unnecessary for me to tell you that this little book gives you only the merest outline of a few of the numerous articles used for food. Enough has, I trust, been said to show you that we are surrounded by blessings, that every want has been provided for, and that it rests only with us to make the proper use of all the gifts which our Divine Father has so bountifully bestowed upon us.

THE END.

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46.	Mahogany Case, same as preceding, with addition of 5-inch Divider, white handle Drawing Pen . .	6	0
45.	Mahogany Case, containing Compasses with shifting legs, Ink and Pencil Points, Dotting Pen, Lengthening Bar, Divider, Drawing Pen, Plotting Scale, Ebony Parallel	7	6
44.	Mahogany Case, with Lock and Key, containing Steel-pointed Compass, Divider, Ink and Pencil and Dotting Point, Bar, Bow Pen, Two Drawing Pens, Ebony Rule, Scale, and Protractor . .	15	0
43.	Mahogany Case, with Lock and Key, containing best finished Brass Sector-joint Compasses, ditto Divider, Ink Point with Screw through joints, Pencil Point, best Spring Bow Pen and Pencil, Ivory Ruling Pen, Parallel, Protractor, Scale . .	30	0
42.	Set, as above, in Rosewood Case, with Spring Bow Pen, Bow Pencil and Dividers, Two Ivory Ruling Pens, Ivory Scale, Ebony Parallel, Boxwood Protractor	45	0
41.	Best lined Rosewood Case, containing Instruments in German Silver, viz., Compass with shifting leg, Ink and Pencil Point, Bar, Bow Pen and Pencil, set of Three Spring Bows, Jointed Pen, Steel Pen, Ivory Parallel, Rule, Protractor, and Scale . .	63	0
40.	Handsome Brass Capped and Cornered Case, containing Two Trays, with the following highly-finished Instruments in German Silver, viz.: Compass with Two Knee Joints and Needle Points, Pen and Pencil, Needle, Hair Spring Divider, Three Needle-pointed Spring Bows, Ink and Pencil Bow, with double Knee-joints, Needle Point, Tracing Point on Ivory Handle, Jointed and Steel Pens, Proportional Compass, Three Ivory Rules . . .	105	0

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119.	Containing 9 large Cakes, Compass, Stumps, Crayons, &c.	2	6

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54.	Containing 18 large Cakes, Brushes, Crayons, &c., lock and key	7	6
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